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DEVICE AND METHOD FOR TRANSPORTING CONTAINERS

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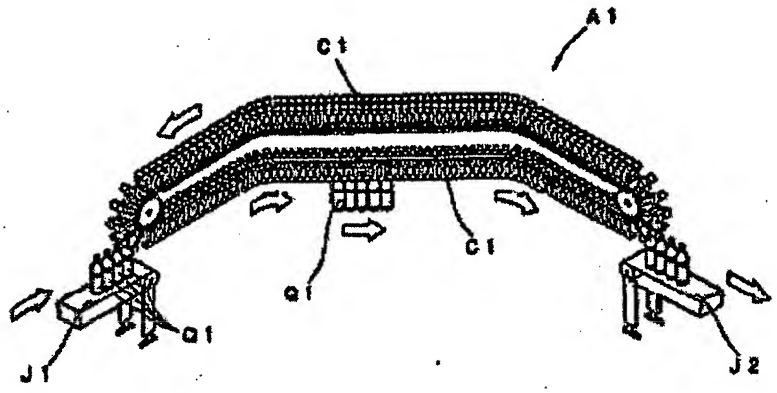

(57) Abstract

A device and a method for transporting containers capable of suitably preventing the containers from falling down during the transportation, eliminating the need for stopping a production line even if the containers are fallen down, and also transporting them smoothly in straight direction, changing the transporting direction, and allowing them to move in vertical direction with a simple configuration, wherein the PET bottles (Q1) are transported under the condition that they are held by holders (E1) which are formed integrally with or fixed to conveyor chains (B1) combined with each other in continuous loop shape, and the conveyor chains (B1) are connected rotatably in both vertical and lateral directions so as to guide the containers with guide members (C1) for transportation.

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Technical field

This invention pertains to a container transporting device and method. In particular, it relates to a container transporting device and container conveying method wherein containers can be transported smoothly in a straight line without their falling over in a manufacturing or filling line or the like for containers or the like, and with which changing the transport path is easy.

Background of the technology

In the past, with a manufacturing or filling line, or the like, for containers or the like, the containers would be transported using a conveyor chain. In this case, there are many forms, e.g., the transport direction is a straight line, the transport direction is changed gently vertically or the transport direction is changed laterally, and to change the transport direction laterally in addition to operation in a straight line, the conveyor chain is usually constructed with a turning axis installed such that it can turn laterally in addition to the normal vertical turning orientation, or said conveyor chain is such that the transport direction can be changed vertically and laterally by combining it in a continuous loop form causing lateral play. Then when containers are transported on a manufacturing or filling line for containers, said containers are transported to a specific location by loading the containers onto said conveyor chain. However, in an said container transport device such as this, when advancing at high speed or when the direction of travel of the containers is changed, particularly when the containers are tall and unstable, such as lightweight, hollow PET beverage containers, there is a risk that said beverage containers will fall over. For this reason, on occasion the line must be stopped because a container has fallen in order or to remove it, with the problem of a drop in line-operating rate or of assistance being required, or the problem of needing a complicated structure to accomplish stable transport. Also, with methods for loading containers onto a conveyor, significant vertical movement is difficult, since the containers fall over. So, the objective of the present invention is to provide a container transport device with which containers can ideally be prevented from falling over during transport, which will not require stopping the line even should a container fall over, and, in addition, which has a simple constitution wherein transport in a straight line, change in direction of transport, and vertical movement of containers can be smoothly accomplished.

Disclosure of the invention

The present invention, firstly, is constituted such that said holders are integral with or affixed to said chain members, making it possible for containers to be held and suspended, and the containers that can be suspended by said holders are transported and held while suspended. Since the containers are held while suspended by said holders, the falling-over of said containers can be

prevented, operation of the transport line at higher speed is possible, and, in addition, vertical movement is also possible. Said containers can also be handled smoothly even if they are supplied intermittently and unevenly. Also, because it is a system in which containers are suspended by said holders, even if said containers fall over on the upstream side, said containers that fall over drop below the device without being held, so said containers that fall over during transport do not interfere with the operation of machinery downstream and it is not necessary to stop the line to collect them, and problems, such as a drop in line-operating rate or assistance being required, do not occur. In addition, said containers can be constructed simply and inexpensively since said chain members can be in a single row configuration, and preparation and storage are easy, and adjustment and maintenance are easy. Secondly, [the invention] is characterized by having chain members that are joined such that they can turn vertically, combined in a continuous loop form such that they can travel in a straight line, guide members that guide said chain members in a straight line and vertically, and holders that are integral with or affixed to said chain members, that are formed so that suspendable containers can be held and suspended, and that can switch between a holding mode and release mode for said containers. In the container transport device with the second constitution, in addition to the features of said first constitution, there are chain members that are joined such that they can turn laterally while combined in a continuous loop form such that they can travel in a straight line, and guide members that guide said chain members in a straight line and vertically. So, smooth transport is possible in a straight line and vertically. Thirdly, [the invention] is characterized by having chain members that are joined such that they can turn vertically and laterally and are combined in a continuous loop form such that they can travel in a straight line, guide members that guide said chain members in a straight line, vertically and laterally, and holders that are integral with or affixed to said chain members, that are formed so that suspendable containers can be held and suspended, and that can switch between a holding mode and release mode for said containers. In the container transport device with the third constitution, in addition to the features of said first constitution, chain members joined such that they can turn vertically and laterally are combined in a continuous loop form such that they can travel in a straight line, and guide members guide said chain members in a straight line, vertically and laterally. So, said guide members are guided by said guide members, and the transport direction can be changed smoothly to a straight line, or vertical or lateral direction, as well as to any desired direction. Therefore, the transport spot is not restricted, and layout flexibility is further improved. Fourthly, [the invention] is characterized in that, in said first, second or third constitution, said holders are such that they can hold said containers with a pair of levers pivotally supported such that they can turn, the holding mode and release mode of said holders can be switched by turning said pair of levers, and a switching means is present that switches the holding

mode and release mode of said holders. In the container transport device with the fourth constitution, the holding mode and release mode of said holders can be switched by turning said pair of levers and a switching means is also present that switches the holding mode and release mode of said holders. So, it is possible to switch the holding mode and release mode of said holders with a simple constitution. Fifthly, [the invention] is characterized in that, in said first, second, third or fourth constitution, there is a stop that restricts the degree of holding of said containers by said level members, the holding mode of said holders is held by said stop in a holding mode in which said containers are not constricted, and relative movement in the direction of transport of said containers between said containers and said holders is enabled. In the container transport device with the fifth constitution, there is a stop that restricts the degree of holding of said containers by said levers, the holding mode of said holders is held by said stop in to a holding mode in which said containers are not constricted, and relative movement in the direction of transport of said containers between said containers and said holders is enabled. So, even if there is a difference in the transport speed of said holders and the loading speed or the unloading speed of said containers, said containers can be collected or distributed with a simple constitution due to the relative movement between said containers and said holders. Sixthly, [the invention] is characterized in that, in said fourth or fifth constitution, there is an energizing member that always energizes said pair of levers to the holding side to keep said pair of levers in the holding mode. In the container transport device with the sixth constitution, there is an energizing member that energizes said pair of levers to the holding side and said pair of levers is always kept in the holding mode. So, an operating mechanism to put said holders in the holding mode is unnecessary and a switching mechanism that sets only the region for the release mode, which has a narrow setting range, e.g., a part where the containers are seized and a part where they are released, is sufficient. So, it is not necessary to control the positions of holder guides, etc., in the transport region that takes up most of the device, so the construction can be simple and efficient. Seventhly, [the invention] is characterized in that, in said sixth constitution, said energizing member can obtain an energizing force using magnetic repulsion or attraction. Thus, said energizing member can be set up with a constitution that is simple, with no fear of cutting, and that is inexpensive. Eighthly, [the invention] is characterized in that, in said fourth, fifth, sixth or seventh constitution, said switching means is carried out with a cam mechanism or with magnetic repulsion or attraction. In the container transport device with the eighth constitution, it is possible to switch smoothly between holding and release by said holders with a simple constitution. In particular, in a constitution for the switching means using magnetic repulsion or attraction, it is possible to have a switching means wherein powder from rubbing is not produced, because there is no contact, and with which impact on the holders is also controlled. Ninthly, [the invention] is characterized in that, in said

fourth, fifth, sixth, seventh or eighth constitution, multiple sets of said switching means are disposed, and the hold positions or release positions for said containers can be changed on the travel route of said chain members. In the container transport device in the ninth constitution, multiple sets of said switching means are disposed, and the hold positions or release positions for said containers can be changed on the travel route of said chain members. So, multiple layouts, e.g., transport to a desired position on the route, transport selected from multiple positions, or transport to multiple positions, is possible. Tenthly, [the invention] is characterized by being a container transport method that uses holders that are integral with or affixed to chain members that are combined in a continuous loop form, that can hold suspendable containers suspended and that can also switch between the holding mode and release mode of said containers, and at the original transport position, said holders are switched to the holding mode from said release mode and said containers are held, the containers are transported from said original transport position to any transport destination position in the holding mode while suspended, and at the transport destination position, said holders are switched from said holding mode to said release mode, said containers are released, and [thus] the containers are transported. The container transport device with the tenth constitution is constituted such that said holders are integral with or affixed to said chain members so that the containers can be held and suspended, and the containers that can be suspended with said holders are transported and held while suspended. Since the containers are held and suspended by said holders, said containers can ideally be prevented from falling over, operation of the transport line at higher speed is possible, and in addition, vertical movement is also possible. Said containers can also be handled smoothly even if they are supplied intermittently and unevenly. Also, because this is a system for suspending containers with said holders, even if said containers fall over on the upstream side, said containers that fall over drop below the device without being held. So, it is not necessary to stop the line to collect said containers that fall over during transport and problems such as a drop in line-operating rate or assistance being required do not occur. In addition, said chain member can be constituted in only a single row, a simple and inexpensive constitution is possible, and adjustment and maintenance are also easy.

Brief description of the figures

Figure 1 is a block diagram showing a container transport device based on an application example of the present invention. Figure 2 is an explanatory diagram showing joining of the chain blocks. Figure 3 is a conceptual diagram showing an example of changing the direction of movement to a lateral direction. Figure 4 is a conceptual diagram showing an example of changing the direction of movement to a vertical direction. Figure 5 is an enlarged view of major parts showing the container-holding mode of a holder. Figure 6 is an enlarged view of major parts

showing the container-holding mode of a holder. Figure 7 is an enlarged view of major parts showing the container release mode of a holder. Figure 8 is an enlarged view of major parts showing an example of a container held by a holder with clearance. Figure 9 is an explanatory diagram explaining the relative dimensions of the holder and container. Figure 10 is an explanatory diagram explaining switching between the holding mode and release mode of the holder using a holding cam and a release cam. Figure 11 is an explanatory diagram showing operation of a holder when a container revolves laterally. Figure 12 is an explanatory diagram showing operation of a holder when a container rises or drops vertically. Figure 13 is an explanatory diagram showing an example when a support fork is used. Figure 14 is an explanatory diagram showing an example of a pulley being used in the inner diameter of the bent part of the conveyor chain. Figure 15 is a block diagram showing an example in which the conveyor chain is circulated in a plane. Figure 16 is a block diagram showing another form of the energizing member. Figure 17 is a block diagram showing another form of the energizing member. Figure 18 is a block diagram showing other forms of the energizing member, switching means, and lever.

Preferred embodiments for implementing the invention

The present invention will be explained according to the accompanying figures in order to describe it in more detail. Note that these application examples illustrate examples with containers transported in a single row. Also, a round PET bottle is displayed as an example of the conveyed container. Container transport device (A1) based on the present invention, as shown in Figure 1, has conveyor chain (B1), guide member (C1), holder (E1), holding cam (switching means) (G1), release cam (switching means) (G2), frame (F1), supply conveyor (departure position) J1, move-out conveyor (destination position) J2, and PET bottle (container) (Q1). Said conveyor chain (B1) has multiple chain blocks (chain members) (B10) joined in a continuous loop form, as shown in Figure 1, is mounted around drive wheel (B1a) and follower wheel (B1b), and transmits power from said drive wheel (B1a) to said follower wheel (B1b). Said drive wheel (B1a) is driven by an electric motor, omitted from the figure, and said follower wheel (B1b) is pivotally supported to rotate and is constituted such that they can move freely. Said drive wheel (B1a) and said follower wheel (B1b) are axially supported by said frame (F1). Any type of chain, as discussed later, can be used for said conveyor chain (B1), and as shown in Figure 2, it is formed into a continuous loop form by locking individual chain blocks (B10) with pins (B20) and mounting around said drive wheel (B1a) and said follower wheel (B1b) as described above. Said chain blocks (B10) are formed with resin or the like and, as shown in Figure 2, are formed so that front-end raised part (B12) and back-end recessed part (B14) can lock with each other. A slot (B12a) is also formed in the side wall of said front-end raised part (B12), and an insertion hole

(B14a) is formed in the inner wall on both sides of said back end recessed part (B14) corresponding to said slot (B12a) when locked. Because of this, individual chain blocks (B10) can be locked by inserting said pin (B20) into said slot (B12a) and said insertion hole (B14a) when front-end raised part (B12) and back end recessed part (B14) are locked. In this way, as described above, individual chain blocks (B10) can be locked and said conveyor chain (B1) can be formed into a continuous loop. Also, in this case, said individual chain blocks (B10) are pivotally supported by said pin (B20), so that said chain blocks (B1) that are joined can turn by a prescribed amount vertically around said pins (B20). Because of this, overall movement vertically by said conveyor chain (B10) is possible. In addition, slot (B12a) of said front-end raised part (B12) through which said pin (B20) is inserted is formed into a long hole shape oriented laterally, so that lateral play exists between said pin (B20) and said chain blocks (B10) are joined to rotate freely by a prescribed amount laterally. Because of this, said conveyor chain (B1), as a whole, is free to turn laterally. Also, as shown in Figure 2, a lip part (B10d) that projects laterally at both sides is formed on the top surface of said chain block (B10), and in addition, a lip part (B10e) that projects laterally at both sides is formed on the bottom surface of said chain block (B10). Because of this, as shown in Figures 1 and 2, said chain block (B10) can be guided in a straight line, or vertically and laterally, while being restricted in the vertical orientation, by disposing said guide members (C1) continuously between said lip part (B10d) and said lip part (B10e). Also, as shown in Figure 2, a locking hole (B10f) to mesh with the teeth of said drive wheel (B1a) or said follower wheel (B1b) is formed in the center part of said chain block (B10). Note that said guide members (C1), as shown in Figure 2, are disposed on both sides of said chain block (B10) and are held by said frame (F1) with support part (F1a) as shown in Figure 1. By disposing a pair of said guide members (C1) continuously as shown in Figures 3 and 4 from said feed conveyor (J1) to said delivery conveyor (J2), a route for transporting said container transport device (A1) from said feed conveyor (J1) to said delivery conveyor (J2) can be formed. In this case, as shown in Figure 3, the direction of movement of said transport route can be changed in a horizontal plane between said feed conveyor (J1) and said delivery conveyor (J2). That is, the direction of movement can be curved laterally. This is possible due to the fact that overall said conveyor chain (B1), as a whole, is free to turn laterally as described above. Also, as shown in Figure 4, the direction of movement of said container transport device (A1) can be raised or lowered vertically between said feed conveyor (J1) and said delivery conveyor (J2). As described above, said conveyor chain (B1) can rotate freely in the vertical direction as a whole. Naturally, the container travel route can be constituted to change vertically and laterally by combining simultaneously said transport route in which the direction of movement is curved laterally with said transport route in which the direction of movement is raised or lowered vertically. Said holders (E1) are affixed such that they can open and

close, as shown in Figures 5 and 6, to the bottom surface on the underside of said chain blocks (B10) formed in this way. In concrete terms, a bracket (D14), presenting a T shape when viewed from the side is formed and affixed to the underside of said chain block (B10). A recessed part (D14a) to pivotally support said holder (E1) to allow it to rotate is formed in said bracket (D14), and additionally, an insertion hole (D14b) is formed through said recessed part (D14a) at both sides. Said holder (E1), as shown in Figures 5 and 6, is formed with a pair of levers (E10) presenting an arm shape and disposed facing in left and right pairs inside said recessed part (D14a) of said bracket (D14). They are pivotally supported such that they can rotate by said bracket (D14) as described above by pins (D16) being inserted into said insertion holes (D14b). A pawl (E1a) that projects approximately at a right angle inward is formed, as shown in Figures 5 and 6, at the bottom end of each said lever (E10). In addition, a spring (energizing member) (E20) is fastened across the center part of said levers (E10) so that said pawls (E1a) are always energized to pull together said levers (E10) disposed in said left and right pairs. Therefore, as shown in Figures 5 and 6, said PET bottle (Q1) can be held and suspended, ideally by being placed between the left and right pair of said pawls (E1a) under neck (Q1a) of said PET bottle (Q1). Note that said pins (D16) that pivotally support said pair of levers (E10) are positioned approximately directly above or slightly toward the center with respect to said pawls (E1a). Because of this, when said PET bottles (Q1) are suspended, the weight of said PET bottles (Q1) will not act in a direction that will push said levers (E10) open, a large force is not required for the energizing force by said spring (E20), and minimal force is sufficient. Therefore, it is possible for said spring (E20) to be small, and because a large force does not act on said levers (E10), high rigidity is not required, and greater miniaturization and lighter weight can be achieved. Also, because they are held with a very light energizing force, damage to said PET bottles (Q1) on the holding part can be suppressed. Also, as shown in Figure 12, by tapering both side surfaces of said pawls (E1a) of said levers (E10), a constitution is given in which the tapered surfaces of said adjacent pawls (E1a) will overlap, and a constitution is possible in which opening of space in the direction of movement by said adjacent levers (E10) can be absorbed by the overlap of the tapered surfaces of said pawls (E1a) changing. If constituted in this way, changes in spacing in the direction of movement by said levers (E10) are absorbed by the overlap of the tapered surfaces of said pawls (E1a) changing, so large gaps will not open up between said adjacent levers (E10), and it is possible to more effectively prevent said PET bottles (Q1) from dropping through the gaps between said levers (E10). By also pressing top end angle part (E1b) on the outside of said levers (E10) inward, as shown in Figure 7, said levers (E10) each turn outward around said pin (D16) against the spring force of said spring (E20). This gives a release mode for releasing the holding of said PET bottles (Q1) and for releasing the suspension of said PET bottles (Q1). That is, by opening and closing top-end angle parts (E1b) on the outside of

said levers (E10), it is possible to switch between the holding mode and release mode for said PET bottles (Q1) using said holders (E1). Said pair of levers (E10) is also energized toward the holding side by said spring (E20) and said pair of levers (E10) is always kept in the holding mode, so additional installation of an actuating mechanism to place said holder (E1) in the holding mode is unnecessary. A switching mechanism, such as a cam, is sufficient as a part to give the release mode, which has a narrow setting range, e.g., a part to grasp said PET bottles (Q1) and a portion to release them, so that position control, such as a guide for said holders (E1) in the transport part, which takes up most of the device, is unnecessary, and a simple, efficient construction is possible. In addition, as shown in Figure 5, a stop (E1c) is formed underneath said spring (E20) inside said lever (E10). By setting the height of said stop (E1c), how said PET bottles (Q1) are held can be set. For example, when the spacing of said PET bottles (Q1) being transported must be changed or when they must be rotated, as shown in Figure 8, the height of said stop (E1c) is set higher, turning of said levers (E10) in the closing direction is restricted by the tension of said spring (E20), and [the bottles] are held with a clearance (t) such that said pawls (E1a) of said levers (E10) and said PET bottles (Q1) do not touch. Therefore, relative movement is possible between said holders (E1) and said PET bottles (Q1) even with said PET bottles (Q1) suspended by said holders (E1), so it is possible to change the transport spacing of said PET bottles (Q1) being transported or to rotate them. In concrete terms, by relative movement between said PET bottles (Q1) and said holders (E1) being possible in the direction of transport of said PET bottles (Q1), even if there is a difference in the transport speed of said PET bottles (Q1) by said feed conveyor (J1) or the transport speed of said PET bottles (Q1) by said delivery conveyor (J2) in Figure 1 and the transport speed of said conveyor chain (B1), or when a difference occurs in the container processing capability of equipment installed downstream and the transport speed of the present device in the holding mode, because said PET bottles (Q1) and said holders (E1) can move relatively, the transport spacing of said PET bottles (Q1) can be changed to open up or close the spacing of said PET bottles (Q1), and said containers can be collected or distributed with a simple constitution. For example, in front of the filling device (upstream side), the feed capability of said conveyor chain (B1) for said PET bottles (Q1) is somewhat greater than the filling device, so in that part, said conveyor chain (B1) will advance slightly relative to said PET bottles (Q1) while holding and transporting them. And if said PET bottles (Q1) are supplied unevenly, they can be collected at that part. Note that when the transport angle vertically for said PET bottles (Q1) is steep, to prevent said PET bottles (Q1) from slipping out, the height of said stop (E1c) has a lower value, turning of said levers (E10) in the closing direction caused by the tension of said spring (E20) will be larger, and as shown in Figure 5, said pawls (E1a) of said levers (E10) and said PET bottles (Q1) are in complete contact. Therefore, since said holding members (E1) will hold said

PET bottles (Q1) securely and relative movement between said holders (E1) and said PET bottles (Q1) will be difficult, when the transport direction of said PET bottles (Q1) changes vertically at a steep angle, slipping out of said PET bottles (Q1) can be prevented. Said holders (E1) are also disposed at a shorter pitch (Pe) than pitch (Pq) of said PET bottles (Q1), as shown in Figure 9. Because of this, more of them are disposed than said PET bottles (Q1), so said holders (E1) will be more continuous, and said PET bottles (Q1) can be ideally prevented from falling over or dropping. At the same time, said holders (E1) in the middle can prevent relative movement of said PET bottles (Q1), and PET bottles (Q1) can be held without regard to the spacing of said PET bottles (Q1). Note that, ideally, it is preferable that the pitch (Pe) of said holders (E1) be set at around 30-70% of the outside diameter of said PET bottles (Q1). Said holders (E1) are also additionally disposed so that the gap (Le) between each of said holders (E1) is no more than 10% of the width of the held part (Lq) of said PET bottles (Q1). Therefore, dropping of said PET bottles (Q1) into gap (Le) between said holders (E1) can be prevented. Said holding cam (G1) and said release cam (G2), as shown in Figure 1, are formed with resin members or the like in an approximately arc shape viewed from the side along the outer periphery of said drive wheel (B1a) and said follower wheel (B1b). Said holding cams (G1) are disposed in a left and right facing pair with a prescribed spacing directly above said feed conveyor (J1). Said release cams (G2) are disposed in a left and right facing pair with a prescribed spacing directly above said delivery conveyor (J2). The thickness of said holding cam (G1) and said release cam (G2) gradually increases into an expanded shape in the direction of movement, as shown in Figure 10, and after reaching the apex, the thickness gradually decreases, conversely, in the direction of movement. At the apex, the spacing of said holding cams (G1) and said release cams (G2) disposed in left and right pairs is set so that a specific opening and closing movement is possible by pressing in said top end angle parts (E1b) of said levers (E10). Therefore, as shown in Figure 10, top end angle parts (E1b) of said holder (E1) are opened and closed by said holder (E1) passing said holding cams (G1) and said release cams (G2), so as described above, the holding mode and release mode for said PET bottles (Q1) is switched. Next, the operation and effect of this application example will be explained. As shown in Figure 1, said PET bottles (Q1) are transported in a single row below said conveyor chain (B1) by said feed conveyor (J1). Said conveyor chain (B1) moves around a loop along said guide members (C1) by said drive wheel (B1a) being driven by an electric motor, omitted from the figure. That is, said conveyor chain (B1) will move continuously in the direction of transport of said PET bottles (Q1) on the movement side (bottom surface) of said conveyor chain (B1). At this time, when said holders (E1) descend from the top surface of said conveyor chain (B1) to the bottom surface along the outer periphery of said drive wheel (B1a), as shown in Figure 10, top end angle parts (E1b) of said holder (E1) pass between said pair of holding cams (G1) and said top end angle parts (E1b) are

pushed inward. Then when said top end angle parts (E1b) move to the apex of said pair of holding cams (G1), top end angle parts (E1b) are pressed in by a prescribed amount, said levers (E10) turn, and as shown in Figure 7, said holder (E1) goes into the release mode. Then when said holder (E1) approaches the bottom end of said follower wheel (B1b), said pawls (E1a) of said left and right pair of levers (E10) are below neck (Q1a) of said PET bottle (Q1), so said holding cams (G1) are set to retract at this position. Therefore, because said holder (E1) is held as shown in Figure 5, said pawl (E1a) of said left and right pair of said levers (E10) can reach the space below neck (Q1a) of said PET bottle (Q1), and ideally, said PET bottle (Q1) can be held and suspended by said holder (E1). Also, in this case, said holders (E1), as described above, are disposed at a shorter pitch (Pe) than pitch (Pq) of said PET bottles (Q1) as shown in Figure 9. Because of this, said holders (E1) are more continuous and said PET bottles (Q1) can ideally be prevented from falling over or dropping. That is, said PET bottle (Q1) is not held only by one of said holders (E1) but, depending on the circumstances, is held by a plurality of said holders (E1). In addition, as described above, said holders (E1) are disposed so that the spacing (Le) between each of said holders (E1) will be no more than 10% of the width of held part (Lq) of said PET bottles (Q1), so said PET bottles (Q1) will not drop through space (Le) between said holders (E1) and dropping of said PET bottles (Q1) can ideally be prevented. Then, said PET bottles (Q1) are transported in the direction of the arrow shown in Figure 1 by the turning of said conveyor chain (B1) with said PET bottles (Q1) held by said holders (E1). With a transport line in which the direction of movement by said PET bottles (Q1) formed by said guide members (C1) curves laterally, a shown in Figure 3, said chain blocks (B10) move along said guide members (C1), so said conveyor chain (B1) overall revolves laterally and the direction of transport of said PET bottles (Q1) is changed laterally. In this case, as shown in Figure 11, when lateral revolution radius (R1) exists in the direction of movement of said PET bottle (Q1), for said inside diameter side lever (E10) and outside diameter side lever (E10), the curvature radius of said inside diameter side lever (E10) is smaller than said lateral revolution radius (R1), but the curvature radius of said outside diameter side lever (E10) is larger than said lateral revolution radius (R1). Because of this, as shown in Figure 11, a difference in spacing occurs between said inside diameter side lever (E10) and said outside diameter side lever (E10), and how said pawls (E1a) catch the underside of neck (Q1a) of said PET bottle (Q1) fluctuates, but said pawls (E1a) flexibly follow the shape of neck (Q1a) of said PET bottle (Q1) due to said spring (E20) expanding or contracting with the fluctuation, so the holding mode for said PET bottle (Q1) is securely ensured. In the same way, as shown in Figure 4, with a transport line in which the direction of movement of said PET bottles (Q1) formed by said guide members (C1) rises vertically, because said chain blocks (B10) move along said guide members (C1), entire said conveyor chain (B1) rises and falls vertically, and the direction of transport of said PET bottles

(Q1) is changed vertically. In this case, as shown in Figure 12, when vertical revolution radius (R2) exists for the holding part for said PET bottles (Q1) using said levers (E10), by means of said conveyor chain (B1) and the holding part for said PET bottles (Q1) realized by said levers (E10), said vertical revolution radius (R2) will be larger than the curvature radius of said conveyor chain (B1). That is, the holding part for said PET bottles (Q1) by said levers (E10) will be more open. Because of this, as shown in Figure 12, how said pawls (E1a) catch on neck (Q1a) of said PET bottle (Q1) fluctuates, but due to said spring (E20) expanding or contracting with the fluctuation, said pawls (E1a) can flexibly follow the shape of neck (Q1a) of said PET bottle (Q1), so the holding mode for said PET bottle (Q1) is securely ensured. Then when said PET bottles (Q1) are transported to the top part of said delivery conveyor (J2) as shown in Figure 1, said holder (E1) goes between said pair of release cams (G2) as shown in Figure 10. Then when said holder (E1) moves to the apex of said pair of release cams (G2), top end angle parts (E1b) of said levers (E10) open and close, so said holder (E1) goes into the release mode as shown in Figure 7. Therefore, the holding mode for said PET bottle (Q1) by said holder (E1) is released and said PET bottle (Q1) drops a slight distance onto the surface of said delivery conveyor (J2), as shown in Figure 1, and is transported by said delivery conveyor (J2). Then from this state, said holder (E1) is lifted along said drive wheel (B1a) along said individual chain blocks (B10) onto the return side (top surface) of said conveyor chain (B1), the return side of said conveyor chain (B1) is returned to the opposite side from which said PET bottles (Q1) are transported, and is used again for transporting said PET bottles (Q1) at the top part of said feed conveyor (J1). Note that it is preferable that the movement speed of said feed conveyor (J1), said conveyor chain (B1), and said delivery conveyor (J2) be approximately the same movement speed so that transport to each member will be accomplished smoothly without any falling over. With the constitution for container transport device (A1) based on this application example, as described above, said holders (E1) are integral with or affixed to said conveyor chain (B1), said PET bottles (Q1) can be held and suspended, and said PET bottles (Q1) that can be suspended by said holders (E1) are transported while being held. Because of this, said PET bottles (Q1) can be held suspended by said holders (E1), said PET bottles (Q1) can ideally be prevented from falling over, and the transport line can be operated at a higher speed. Said PET bottles (Q1) can also be handled smoothly even when they are fed intermittently and unevenly. Because this is a system in which said holders (E1) suspend said PET bottles (Q1), when they fall over upstream, said PET bottles (Q1) supplied from said feed conveyor (J1) drop without being held and are recovered in a lower part, so it is not necessary to remove said PET bottles (Q1) from the device, operation of machinery downstream is not hindered, it is not necessary to stop the line to recover said PET bottles (Q1), and problems, such as a drop in line-operating rate or assistance being required, do not occur. Said conveyor chain (B1) is also a suspension system

using said holders (E1) and is smoothly guided by said guide members (C1) as described above, so there is no risk of said PET bottles (Q1) dropping, and stable transport with little vibration can be accomplished. Because of this, it is not necessary to use a plurality of conveyor chains, sufficiently stable transport is possible even with a single row constitution, a constitution that is simple and inexpensive is possible by using a single row, space efficiency can be improved, and adjustment and maintenance is facilitated. Said conveyor chain (B1) is also free to turn vertically and laterally, and is guided by said guide members (C1), so it is possible to change the direction of transport vertically and laterally both smoothly and in any direction. Therefore, the delivery point is not restricted and layout flexibility is further improved. Also, naturally, a constitution in which said conveyor chain (B1) is a straight line travel type and is disposed only in a straight line to transport said PET bottles (Q1) in a straight line, and vertically if necessary, is possible. In this case, too, each of said chain blocks (B10) is guided by said guide members (C1), so smooth transport in a straight line and vertically is possible. With said holders (E1), as a result of the rotating operation of said pair of lever parts (E10), switching between the holding mode and release mode of said holders (E1) is possible, so it possible to switch between holding mode and release mode for said holders (E1) with a simple constitution. In this case, switching between the holding mode and release mode for said holder (E1) is accomplished with a simple mechanism composed of said holding cams (G1) and said release cams (G2). Because of this, smooth switching between the holding mode and release mode for said holders (E1) is possible with a simple constitution. Note that the views from the top of said holding cams (G1) and said release cams (G2) in each of the figures show an expanded shape. Also, because transport and change in direction or movement are carried out while said PET bottles (Q1) are held by said holders (E1), stability is high and operation at a higher speed is possible. Said holders (E1) are also integral with or affixed to the rear surface of said single row of chain blocks (B10), so compared to when multiple rows of chains are used and said holders (E1) are disposed on the side surfaces of said chain blocks (B10), space saving can be achieved, especially in the width direction. Even when different types of said PET bottles (Q1) are transported, differences in the neck diameter of said PET bottles (Q1) can be absorbed by said holders (E1), so it is possible to transport different types of said PET bottles (Q1) on the same line without adjustment or replacing holders. In addition, the major components, such as the conveyor and holders, can easily be made of plastic, so the device can be made lubrication-free and cleaning will also be easy, making a hygienic constitution possible. A constitution that can ideally be applied to beverage filling lines, or the like, in which the hygienic aspect is considered important, can be produced. Note that the present invention is not limited to the constitution of said application example, and various forms within a scope that does not deviate from the gist of the present invention are possible. For example, sliding of said chain blocks (B10)

and said guide members (C1) is constituted using resin in this application example, but this is not a limitation. As long as said chain blocks (B10) can slide smoothly against said guide members (C1), any [type] such as a constitution using bearings or using rollers, or the like, is included. Also, the application example is constituted to transport said PET bottles (Q1), but as long as suspension by holders is possible, any [type], such as two-liter bottles, milk bottles, or mug-type containers with handles, is included. Note that in this application example, said PET bottle is used in the sense of indicating bottles made of polyester terephthalate. And naturally, said conveyor chain (B1), guide members (C1), holders (E1), said holding cams (G1), said release cams (G2), and the like are set up arbitrarily according to the weight and size of the containers to be transported, speed, etc. For example, if said containers are reliably lightweight items, each of said members is constructed with an oil-containing resin or the like, and when said containers are relatively heavy items, each of said members is constructed using steel or stainless steel or the like. Control of the electric motor, omitted from the figures, which drives said conveyor chain (B1), as desired is suitable, e.g., control using an electrical circuit or microcomputer based on signals from sensors disposed up and down the line. Also, as shown in Figures 5 and 6, a constitution can be used in which a dustproof plate (E30) is placed at the top of said PET bottles (Q1) when the open containers are empty, before said PET bottles (Q1) are filled with a beverage, water, or the like, to prevent dust or dirt from getting into said PET bottles (Q1). In addition, as indicated by the double dot-and-dash line in Figure 5, by using a constitution in which said pair of stops (E1c) have a shape with a step to engage with each other and are disposed close to said PET bottles (Q1) at the top part of said PET bottles (Q1), a constitution that prevents dust and dirt from entering into said PET bottles (Q1) using said stops (E1c) is possible. That is, even when said levers (E10) turn, said stops (E1c) overlap at the step part, so entry of dust and dirt into said PET bottles (Q1) can be prevented. With such a constitution, said stops (E1c) and dustproof plate (E30) can be one item, and a constitution is possible that will prevent entry of dust or dirt into said PET bottles (Q1) is possible with a simple constitution having a smaller number of components. When said PET bottles (Q1) are transferred from said feed conveyor (J1) to said holders (E1), or when said PET bottles (Q1) are transferred from said holders (E1) to said delivery conveyor (J2), as shown in Figure 13, a support fork (S1), with a gradually changing thickness can be disposed below neck (Q1a) of said PET bottle (Q1). Said operations can be carried out more smoothly and reliably by using such a constitution. When the direction of movement of said PET bottles (Q1) curves significantly laterally, in place of said guide members (C1) that guide the inner circumference side of said conveyor chain (B1), as shown in Figure 14, a pulley (C10) formed at approximately the same thickness as said guide member (C1) and formed with approximately the same radius as the curvature of radius on the inner circumference side in the direction of movement of said PET bottles (Q1) can be used. By

constituting in this way, the sliding resistance on the inner circumference side of said conveyor chain (B1) is reduced, so the direction of movement by said conveyor chain (B1) can be changed smoothly. For said chain blocks (B10) in said conveyor chain (B1), with this application example, vertical movement is configured by axial support using said pins (B20) and movement laterally uses one axis produced by the play in said pins (B20), but this is not the only possible constitution. Lateral movement could also be configured using axial support or a constitution could have the form of free-moving joints using two axes. Also, with this application example, said conveyor chain (B1) is constituted to be free to turn either vertically or laterally, but, naturally, it could also have a constitution for transporting only in a straight line, or a constitution for turning only vertically or a constitution for turning only laterally, limiting its function to only one direction. Note that with this application example, as shown in Figure 2, a lip part (B10d) is furnished for said chain block (B10), and it could be in the form of a round rod or the like, and as the constitution for guiding along the top and bottom of the part where said lip part (B10e) and said bracket (D14) are mounted, said lip part (B10d) can also be eliminated. Also, with this application example, said conveyor chain (B1) is mounted around said drive wheel (B1a) and said follower wheel (B1b) to circulate three-dimensionally by transporting on the bottom and rewinding back on the top, but said conveyor chain (B1) is also be free to turn laterally, so as shown in Figure 15, it can also circulate in a plane such that each of said chain blocks (B10) is always facing forward. In concrete terms, said guide members (C1) are formed in pairs on the inside and the outside in a planar loop form, and said conveyor chain (B1) to which said holders (E1) are affixed is disposed between them in a loop form. Said drive wheel (B1a) for driving said conveyor chain (B1) to rotate and any number of said follower wheels (B1b) are also disposed in a plane form. Therefore, an engaging hole, omitted from the figure, that engages with the teeth of said drive wheel (B1a) or said follower wheel (B1b) is formed in the side surface of said chain block (B10). By constituting in this way, each of said chain blocks (B10) will circulate always facing forward, which will give an endless constitution that can continue to hold said PET bottles (Q1), and said PET bottles (Q1) can be held and released at any position without differentiation as a starting or final end for said conveyor chain (B1). Also, as shown in Figure 15, by disposing a plurality of said holding cams (G1) or release cams (G2) along the travel route of said conveyor chain (B1) and switching said holding cams (G1) or release cams (G2) to positions where they can push or cannot push said holders (E1) with air cylinders or the like, omitted from the figure, any position in the travel route of said conveyor chain (B1) can be selected and said PET bottles (Q1) can be held and released. For example, as shown in Figure 15, the final lot (Q1y) of said PET bottles (Q1) is to be transported from said feed conveyor (J1) to said delivery conveyor (J2a) and the next lot (Q1z) is transported from said feed conveyor (J1) to said delivery conveyor (J2b). Conversely, said PET bottles (Q1)

can be collected and transported from a plurality of said feed conveyors (J1) to one of said delivery conveyors (J2). Therefore, a container transport device that has the function of a transport container branching device, a collecting device, an allocating device, and the like is possible. In addition, also in the energizing member and switching member for said holders (E1), with the constitution in this application example, as described above, the constitution uses a tension spring (spring (E20) and cams (holding cams (G1) and release cams (G2)), but this is not a limitation and various forms are possible. For example, as the energizing member, a constitution that obtains energizing force to energize said holders (E1) using a compression spring, leaf spring, magnetic repulsion, or attraction is possible. As the switching means, a constitution that switches between the holding mode and release mode using magnetic repulsion or attraction, a constitution that opens and closes by bringing a push member against said holders (E1) using a solenoid, or any other constitution, as long as it can open and close said holders (E1) smoothly and the holding mode can be maintained, may be included. For example, concretely explaining an example that uses a compression spring as said energizing member, as shown in Figure 16, an engaging hole (E10a) is formed approximately in the center part of said left and right levers (E10), a plate (D20) that extends from the bottom end of said bracket (D14) inward is formed, and a threaded hole (D20a) is formed at a spot on said plate (D20) opposite said engaging hole (E10a). A spring (E50) is also disposed in said engaging hole (E10a), and by tightening a bolt (E40) in said threaded hole (D20a), a constitution in which said levers (E10) are always energized in the closed direction is given. Concretely explaining an example that uses magnetic repulsion as said energizing member, as shown in Figure 17, a magnet (M10) is disposed at a spot at the top end on the inside of said left and right levers (E10), a raised part (D30) is formed inside recessed part (D14) of said bracket (D14), and a magnet (M20) set with its magnetic pole oriented to be repulsed by the polarity of said magnet (M10) is disposed at a spot on said raised part (D30) opposite said magnet (M10). Because of this, a constitution in which said levers (E10) are always energized in the closing direction by the repulsive force of said magnet (M10) and said magnet (M20) is given. Concretely explaining an example that uses magnetic attraction as said energizing member, as shown in Figure 18, magnets (M30) and (M40) are disposed at a location on the inside in the center part of said pair of levers (E10) facing each other so that their poles will attract each other. Because of this, under the attraction of said magnets M30 and M40, a constitution in which said levers (E10) are pulled together reciprocally and said levers (E10) are always energized in the closing direction is given. In addition, concretely explaining an example that uses magnetic repulsion as said switching means, as shown in Figure 18, magnets (M50) and (M60) are disposed facing outward on top end angle parts (E1b) of said left and right levers (E10). Magnets (M70) and (M80) are also disposed at the hold position and release position for said PET bottles (Q1) where switching of said

holders (E1) is required and at spots opposite said magnets (M50) and (M60) so that said magnets (M50) and (M60) and their [(M70) and (M80)] magnetic poles will repel. Therefore, by said magnets (M50) and (M60) and said magnets (M70) and (M80) being repelled at the hold position or release position for said PET bottles (Q1), the energizing force of the energizing member energizing said levers (E10) to the holding side is canceled out and top end angle parts (E1b) at the top of said levers (E10) are pushed in, so said levers (E10) can be turned to the open side. Note that when said energizing means obtains energizing force using magnetic repulsion or attraction, a constitution results that is simple and inexpensive with no concern of cutting or the like. In a constitution in which said switching means uses magnetic repulsion or attraction, a switching means is possible with which powder caused by rubbing is not produced because there is no contact, and with which impact on the holders is controlled. Also, in Figure 18, said left and right levers (E10) are constituted pivotally supported by individual pins (D16), but it is possible to share said pin (D16), and by constituting in this way, a holder constitution that is inexpensive and simple is possible.

Possibility of use in industry

This invention, as above, is applied to a container transport device and a container transport method with which containers transported at high operating speed will not fall over. Even if they fall over, the line is not stopped, efficient transport is achieved, and straight line transport, changes in the transport path, and movement of the containers vertically is possible.

Claims

1. A container transport device characterized by having chain members combined into a continuous loop form, and holders that are integral with or affixed to said chain members, that can hold and suspend suspendable containers, and that can switch between the holding mode and release mode for said containers.

2. A container transport device characterized by having chain members that are joined such that they can travel in a straight line and can turn vertically and are combined into a continuous loop form, guide members that guide said chain members in a straight line and vertically, and holders that are integral with or affixed to said chain members, that can hold and suspend suspendable containers, and that can switch between the holding mode and release mode for said containers.

3. A container transport device characterized by having chain members that are joined such that they can travel in a straight line and can turn vertically laterally and are combined into a continuous loop form, guide members that guide said chain members in a straight line and

vertically and laterally, and holders that are integral with or affixed to said chain members, that can hold and suspend suspendable containers, and that can switch between holding mode and release mode for said containers.

4. The container transport device described in Claim 1, 2 or 3 characterized in that said holders are able to hold said containers with a pair of levers pivotally supported such that they can turn, it is possible to switch between the holding mode and release mode of said holders by the turning of said pair of levers, and there is a switching means that switches between the holding mode and release mode of said holders.

5. The container transport device described in Claim 1, 2, 3 or 4 characterized by having a stop that regulates holding of said containers by said levers, the holding mode of said holders is kept by said stop in a holding mode in which said containers are not constricted, and relative movement of said containers and said holders in the direction of transport of said containers is possible.

6. The container transport device mentioned in Claim 4 or 5 characterized by having an energizing member that energizes said pair of levers toward the holding side to always keep said pair of levers in the holding mode.

7. The container transport device described in Claim 6 characterized in that said energizing member obtains energizing force by magnetic repulsion or attraction.

8. The container transport device described in Claim 4, 5, 6 or 7 characterized in that said switching means is carried out with a cam mechanism, or magnetic repulsion or attraction.

9. The container transport device described in Claim 4, 5, 6, 7 or 8 characterized in that multiple sets of said switching means are disposed, and the hold position or release position for said containers can be changed on the travel route of said chain members.

10. A container transport method characterized in that holders are used that are integral with or affixed to chain members that are combined in a continuous loop form, that can hold and suspend suspendable containers, and that can also switch between the holding mode and release mode for said containers, and at the original transport position, said holders are switched to the holding mode from said release mode and said containers are held, the containers are transported from said original transport position to any transport destination position in the holding mode while suspended, and at the transport destination position, said holders are switched from said holding mode to said release mode, said containers are released, and [thus] the containers are transported.

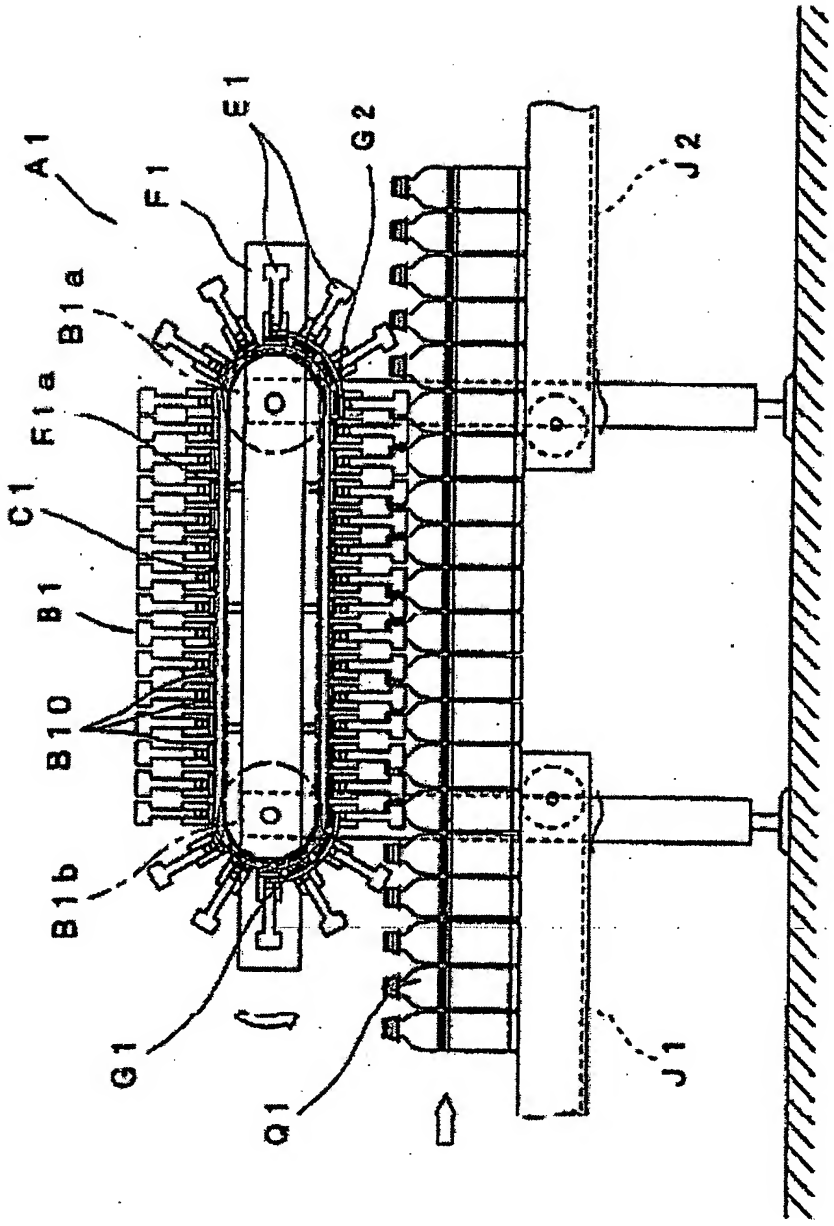


Figure 1

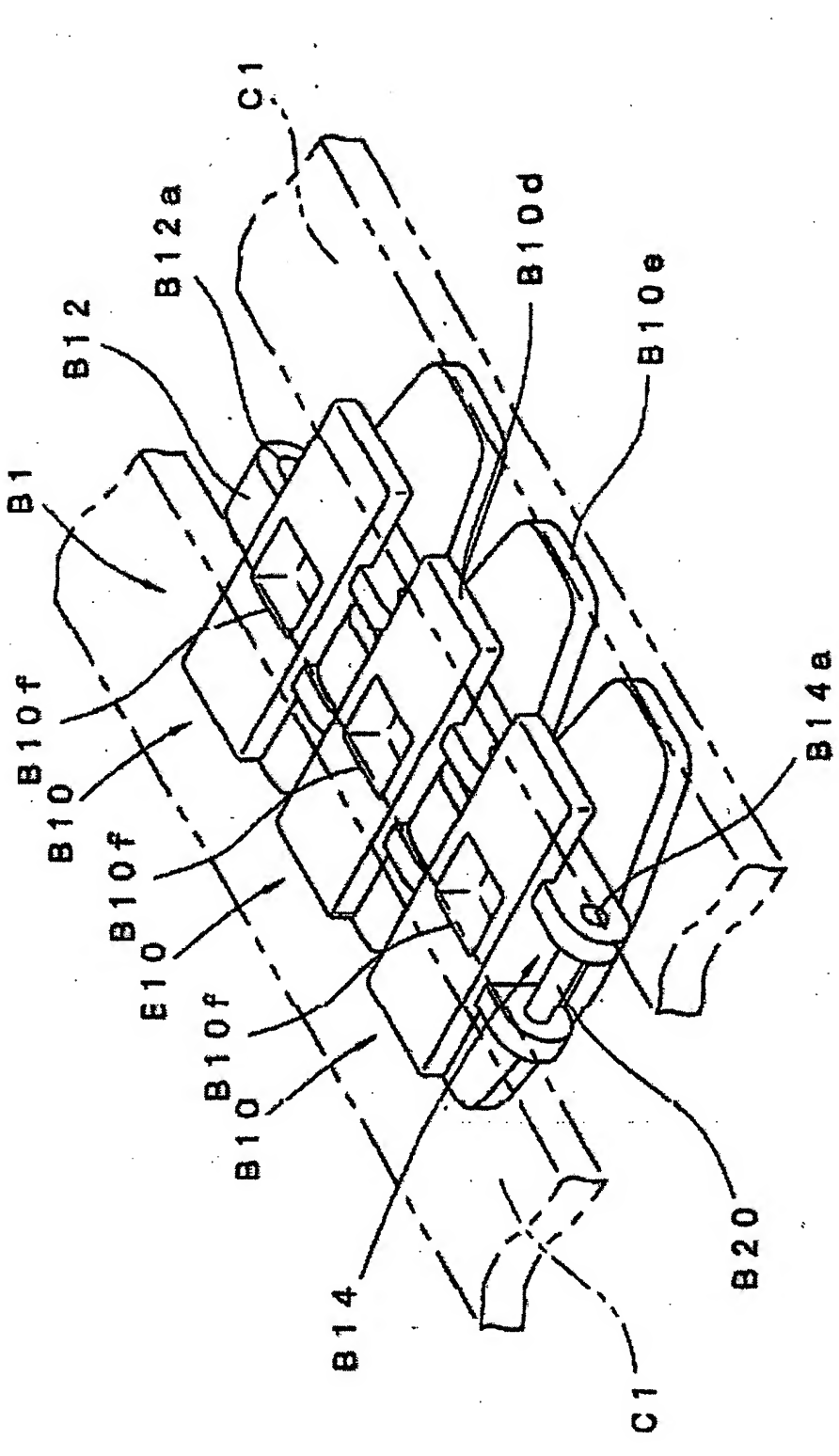

C1
B12a
B12
B1
B10f
B10
B10f
E10
B10f
B10
B14
C1
B20
B14a
B10e
B10d

Figure 2

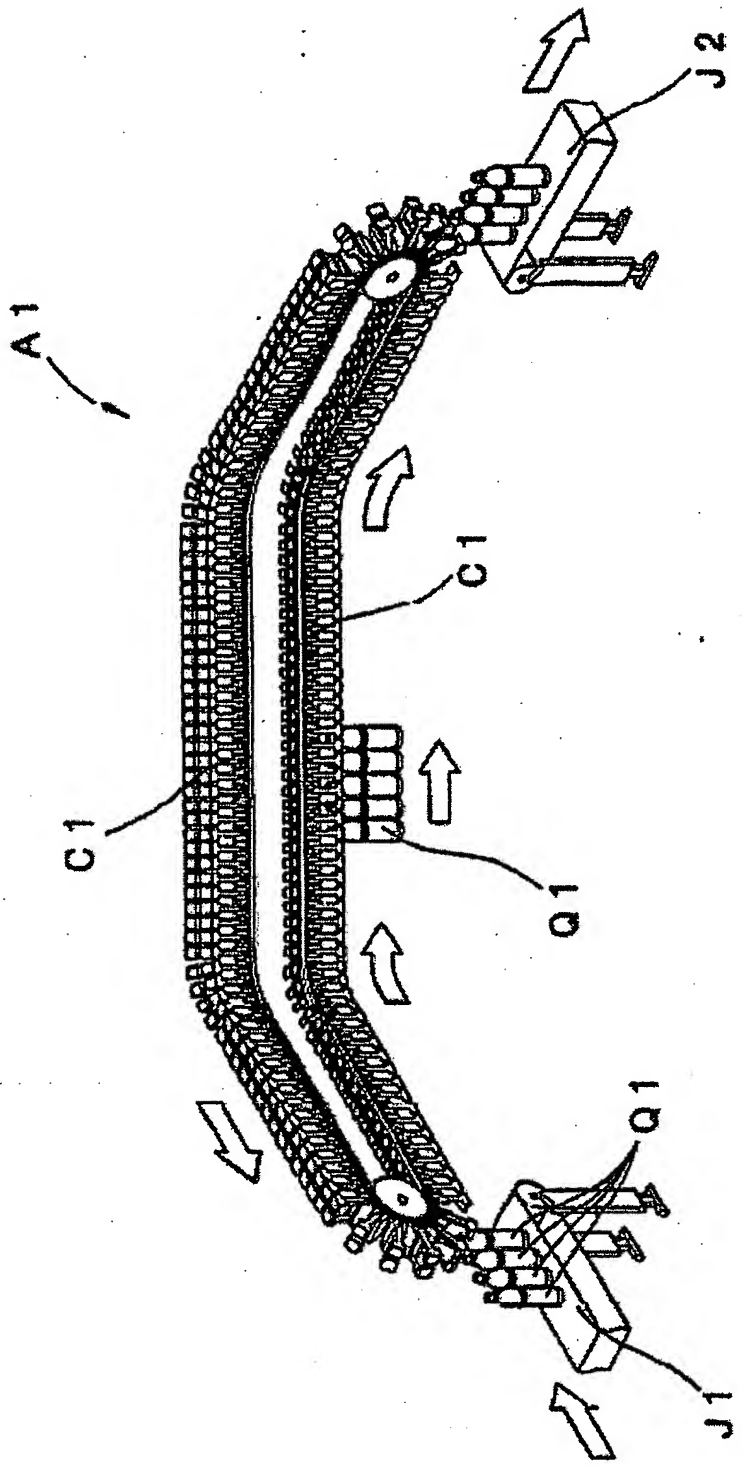
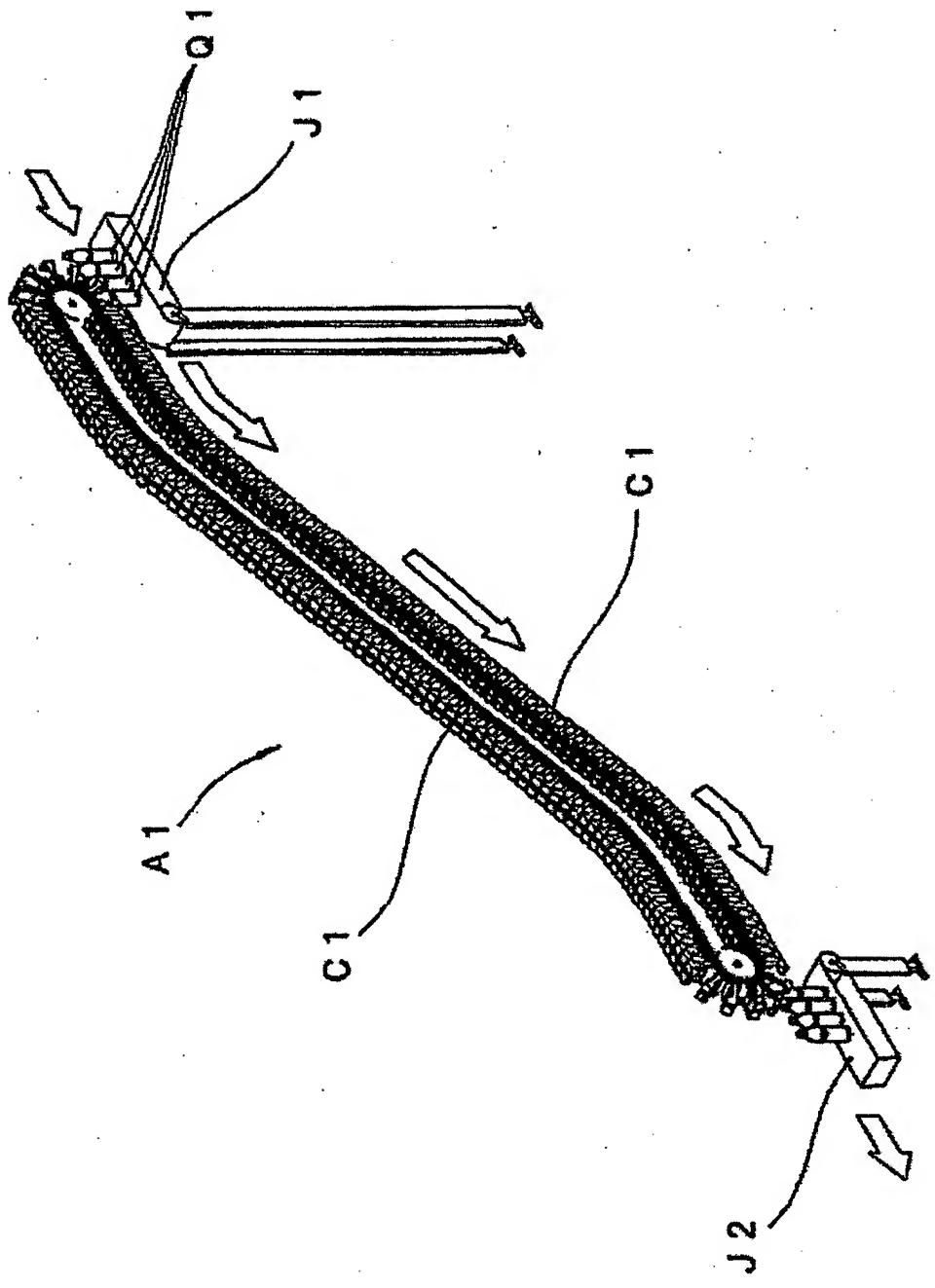


Figure 3



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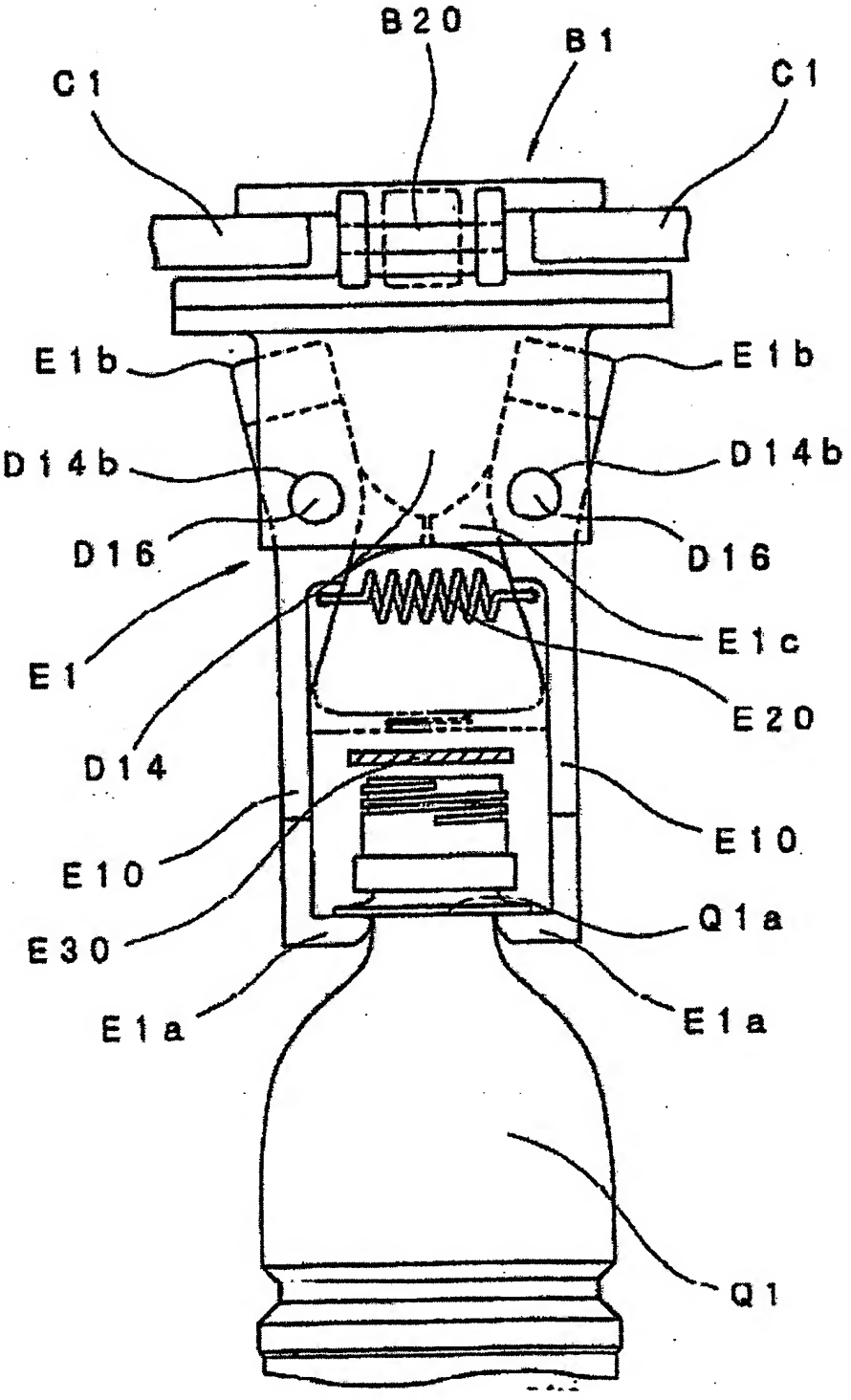
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C1
C1
E1b
E1b
D14b
D14b
D16
D16
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E1
E20
D14
E10
E10
Q1a
E30
E1a
E1a
Q1

Figure 5

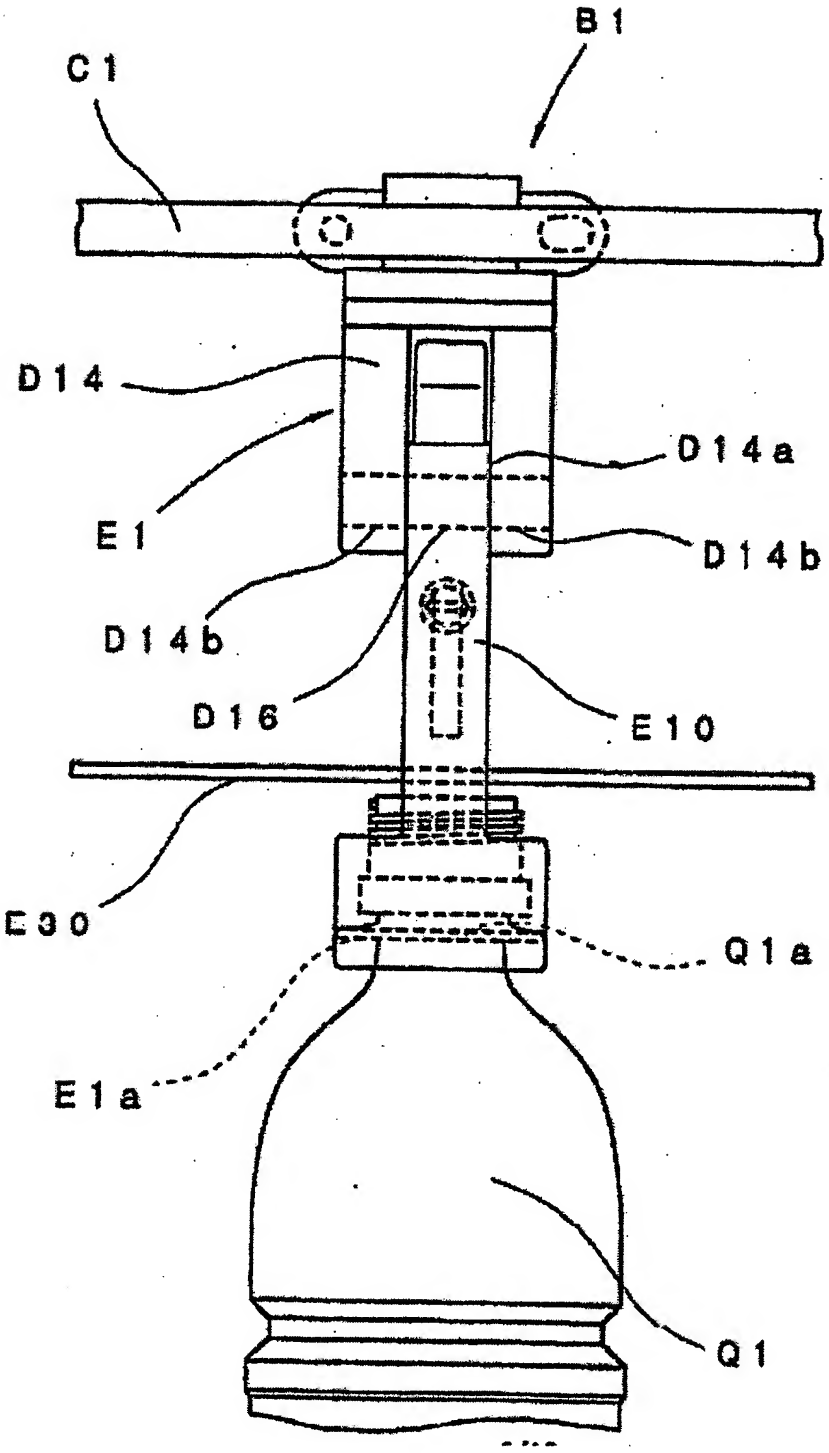
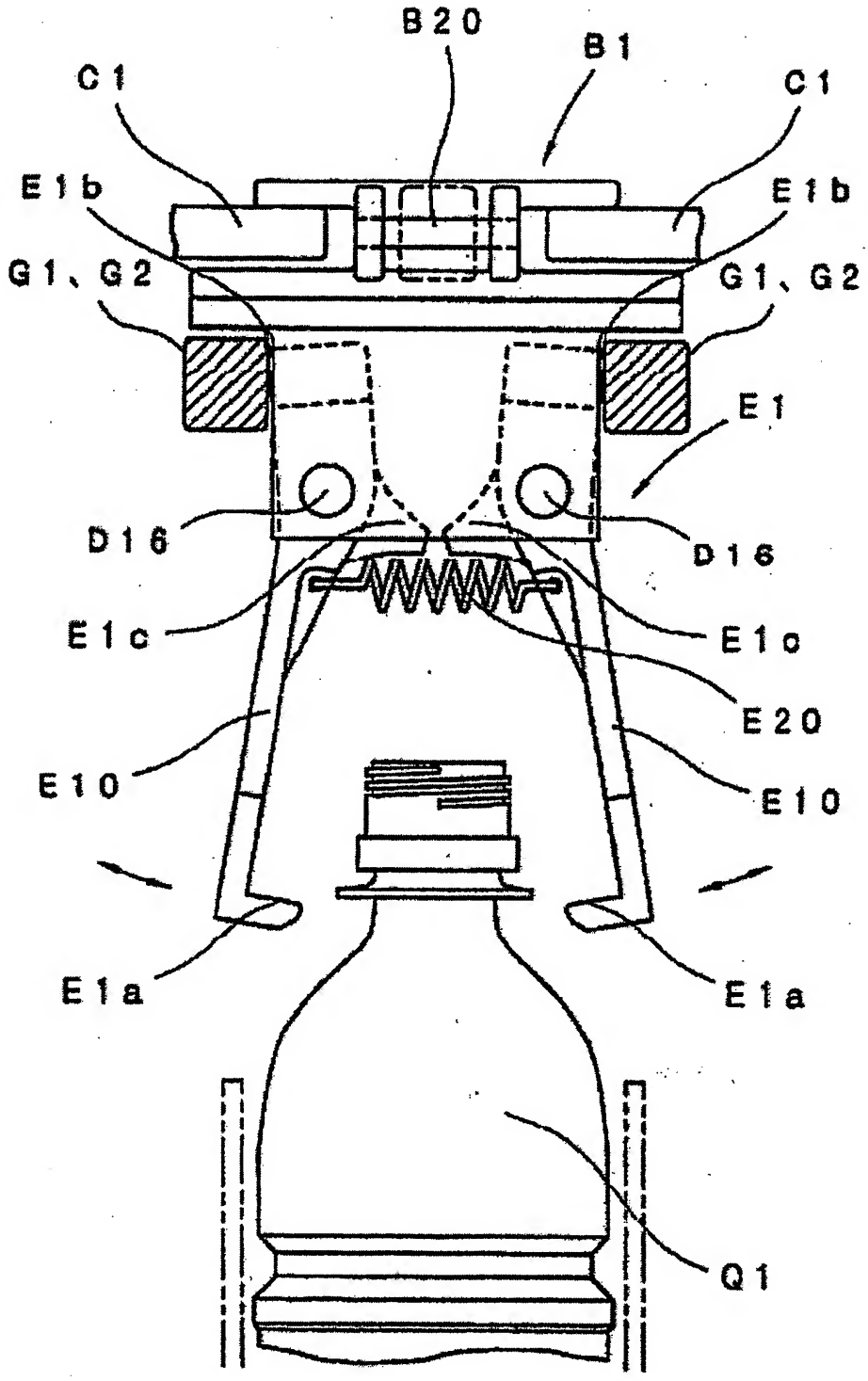


Figure 6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B1
C1
C1
E1b
E1b
G1、G2
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D16
D16
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E1c
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E10
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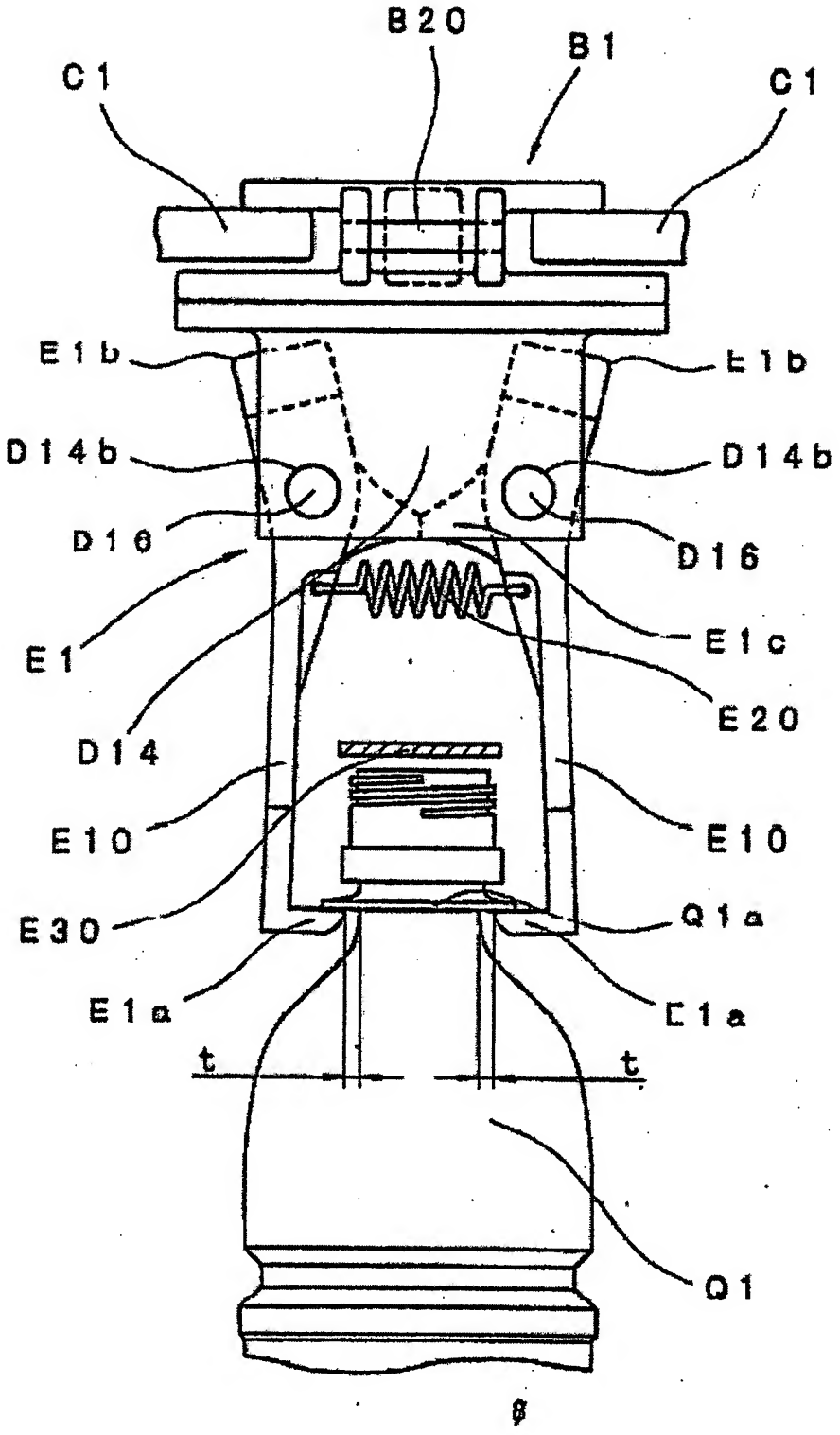
E1a
E1a
Q1

Figure 7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D16
D16
E1
E1c
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D14
E10
E10
E30
Q1a
E1a
E1a
t
t
Q1
β

Figure 8

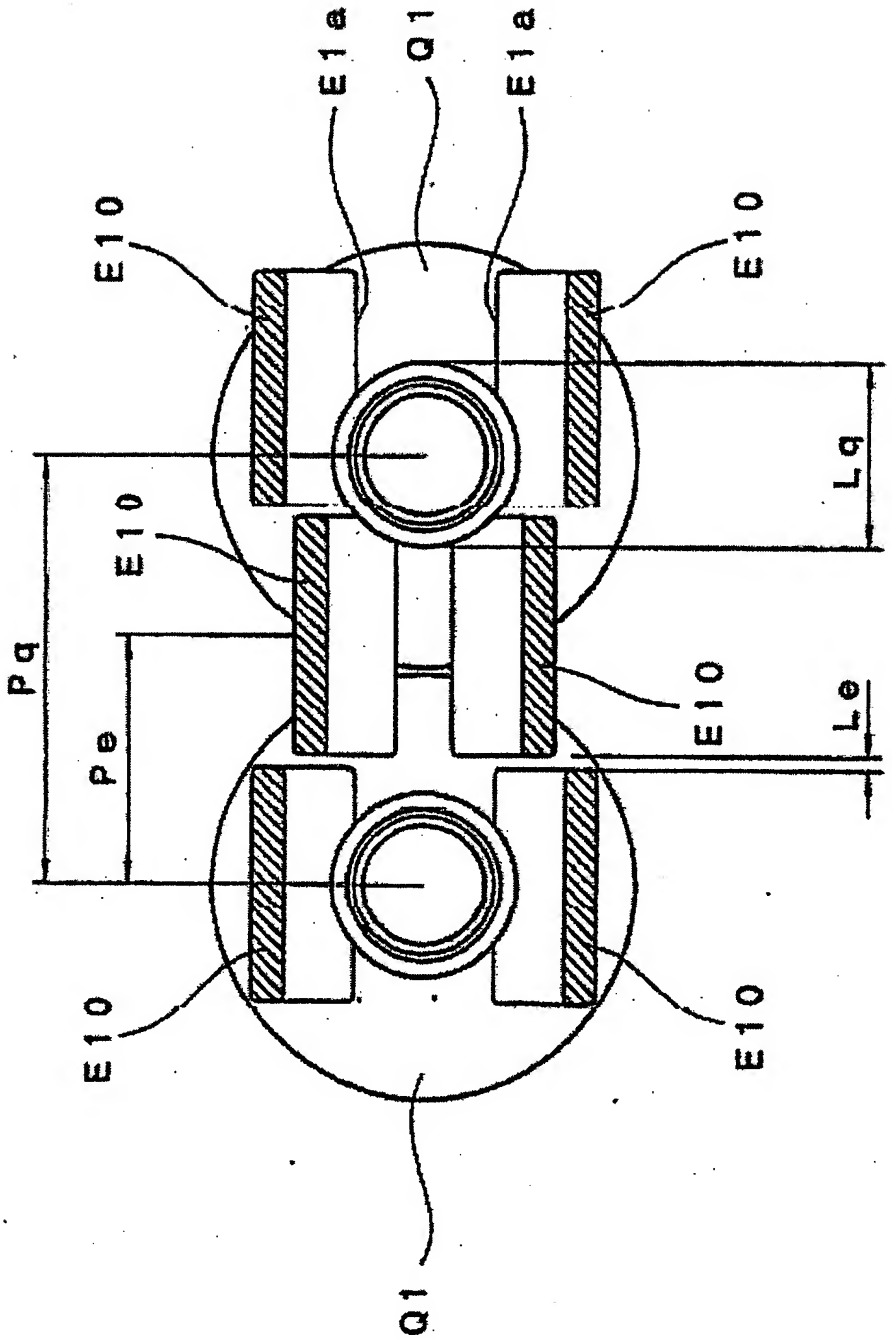


Figure 9

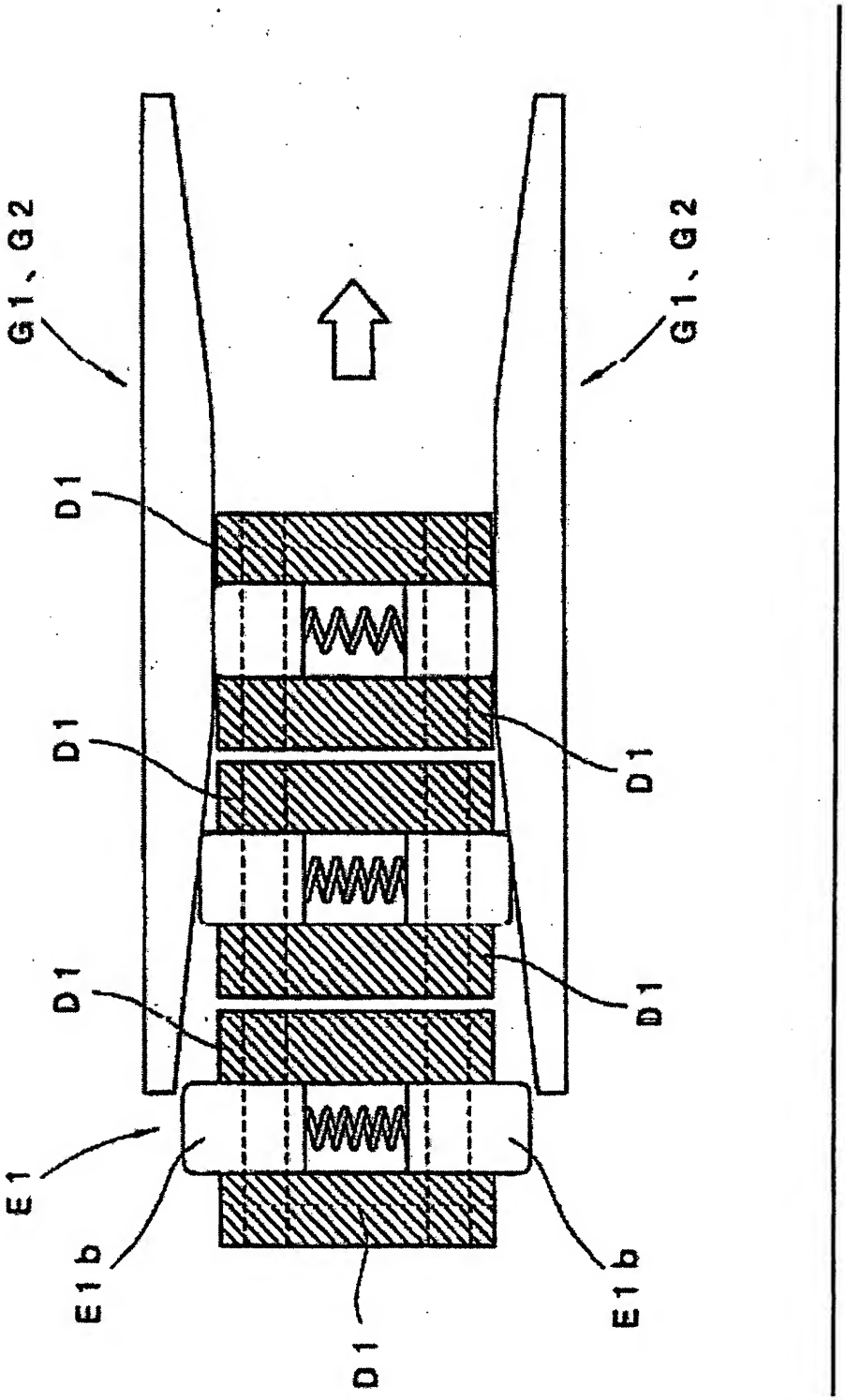


Figure 10

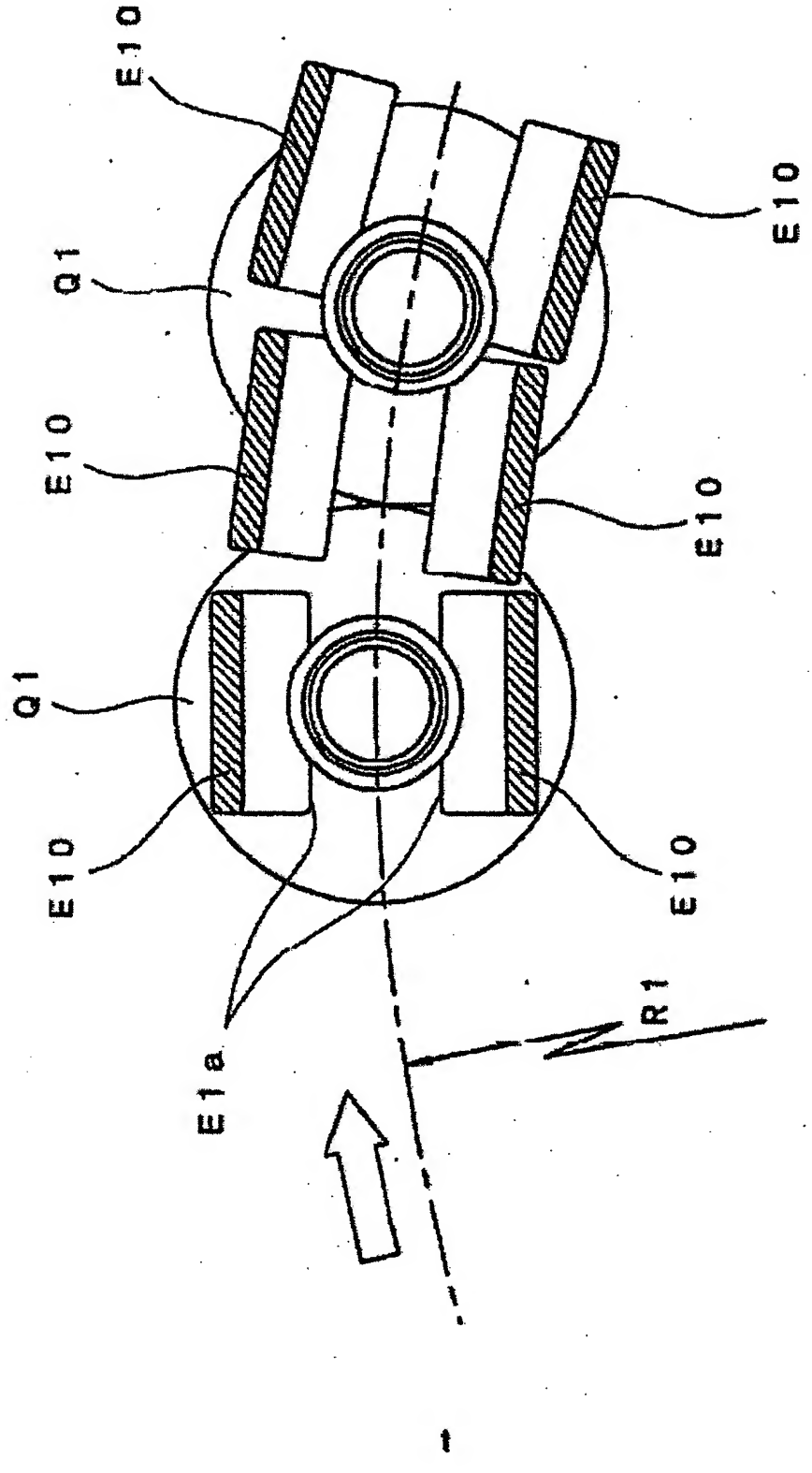


Figure 11

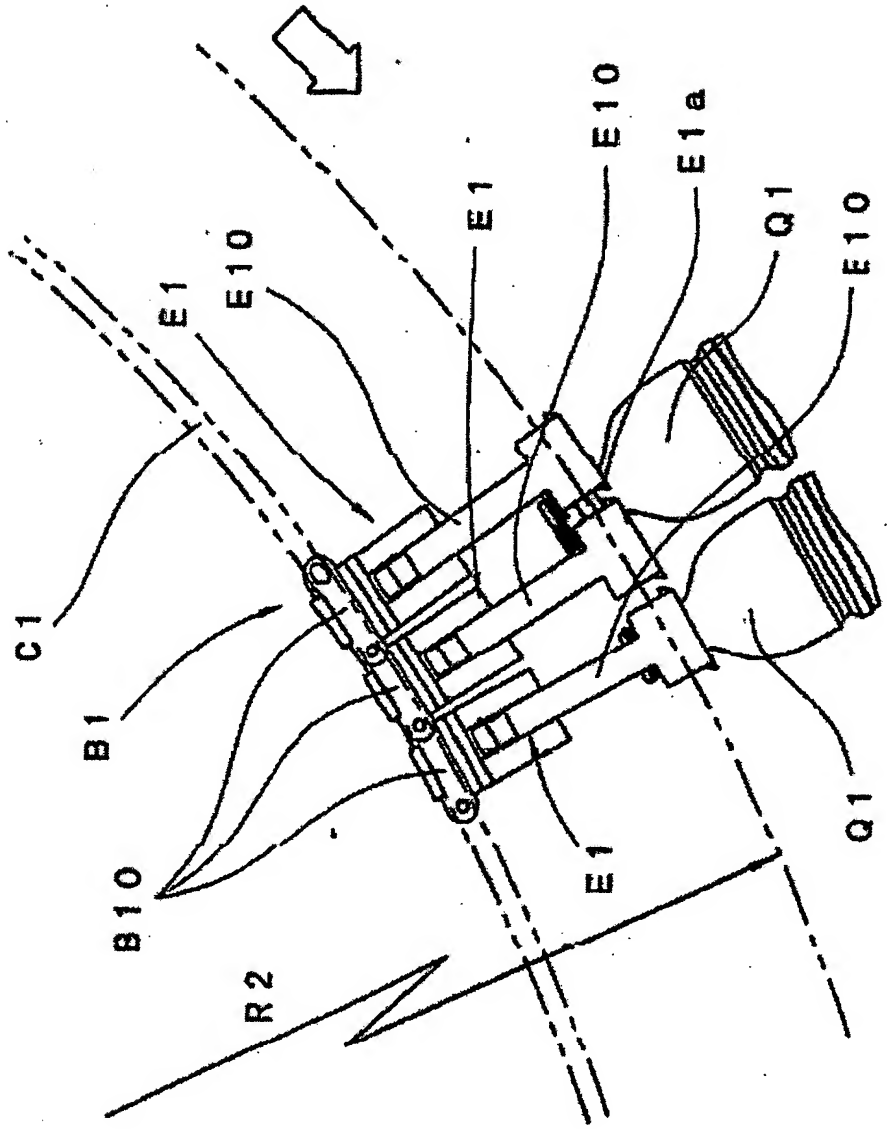


Figure 12

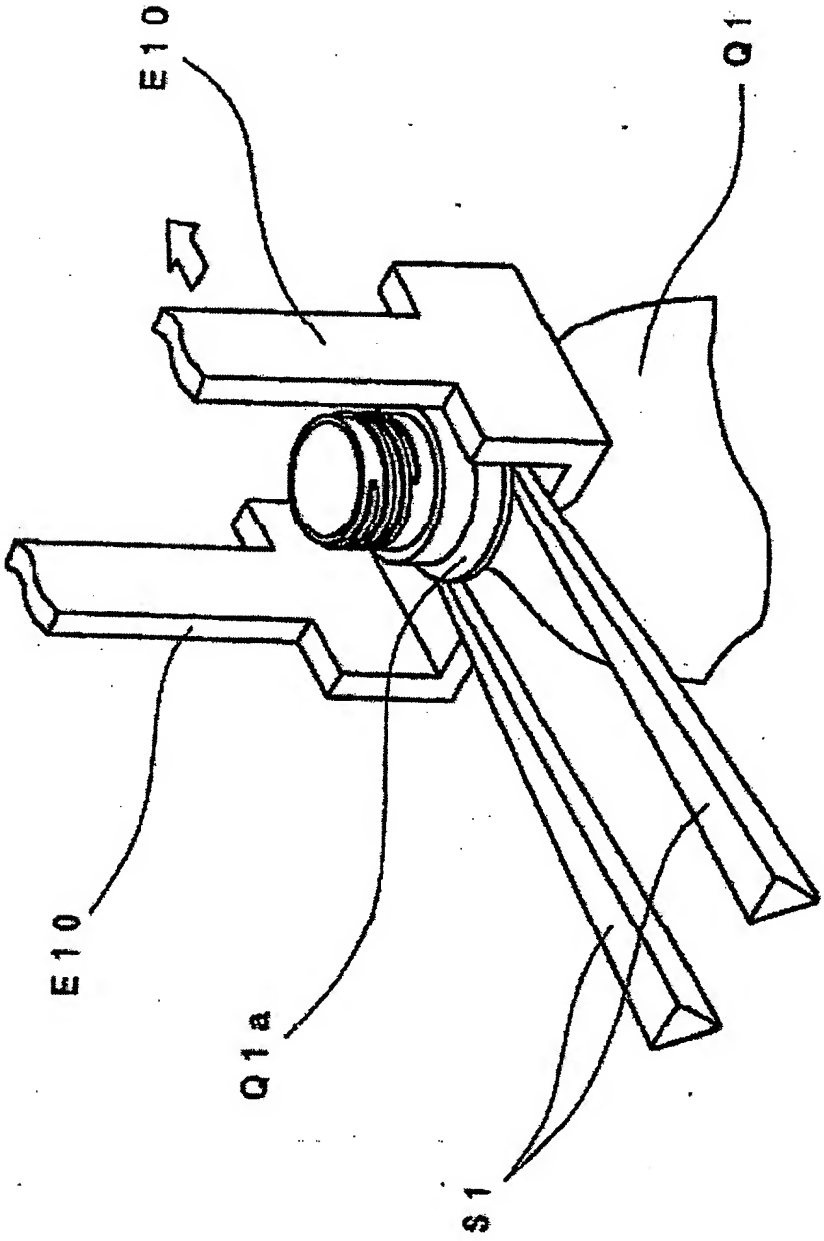


Figure 13

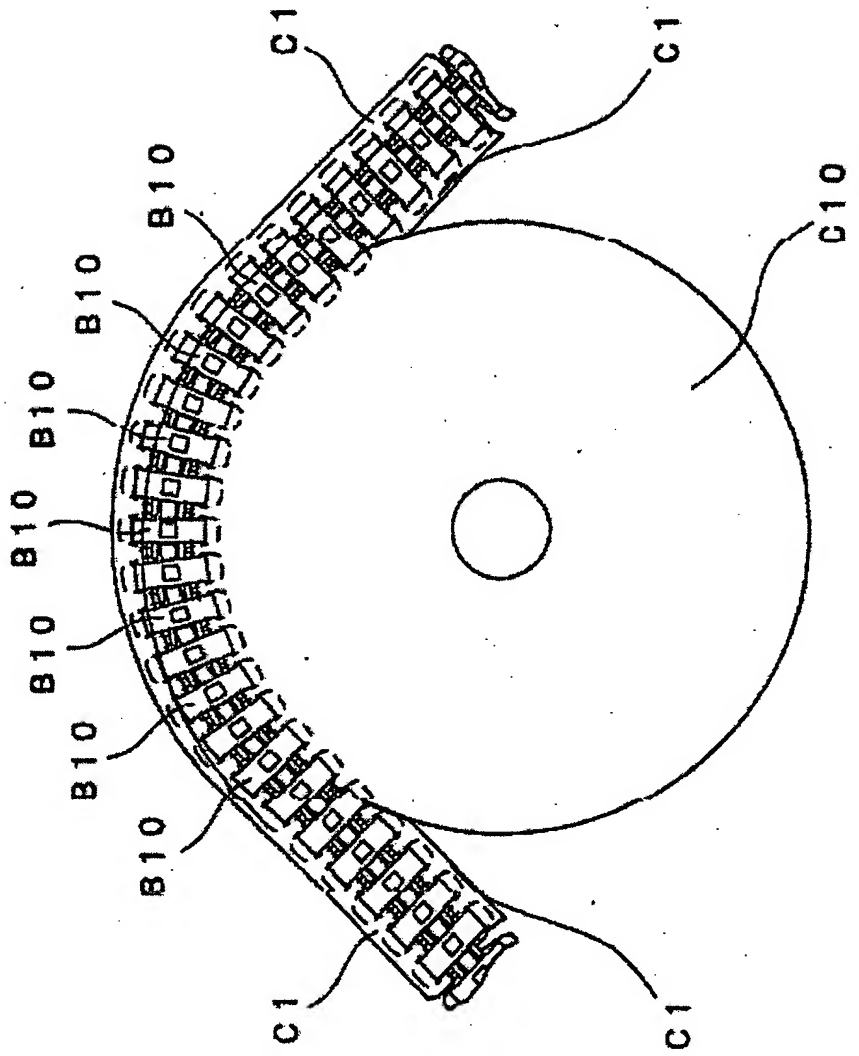


Figure 14

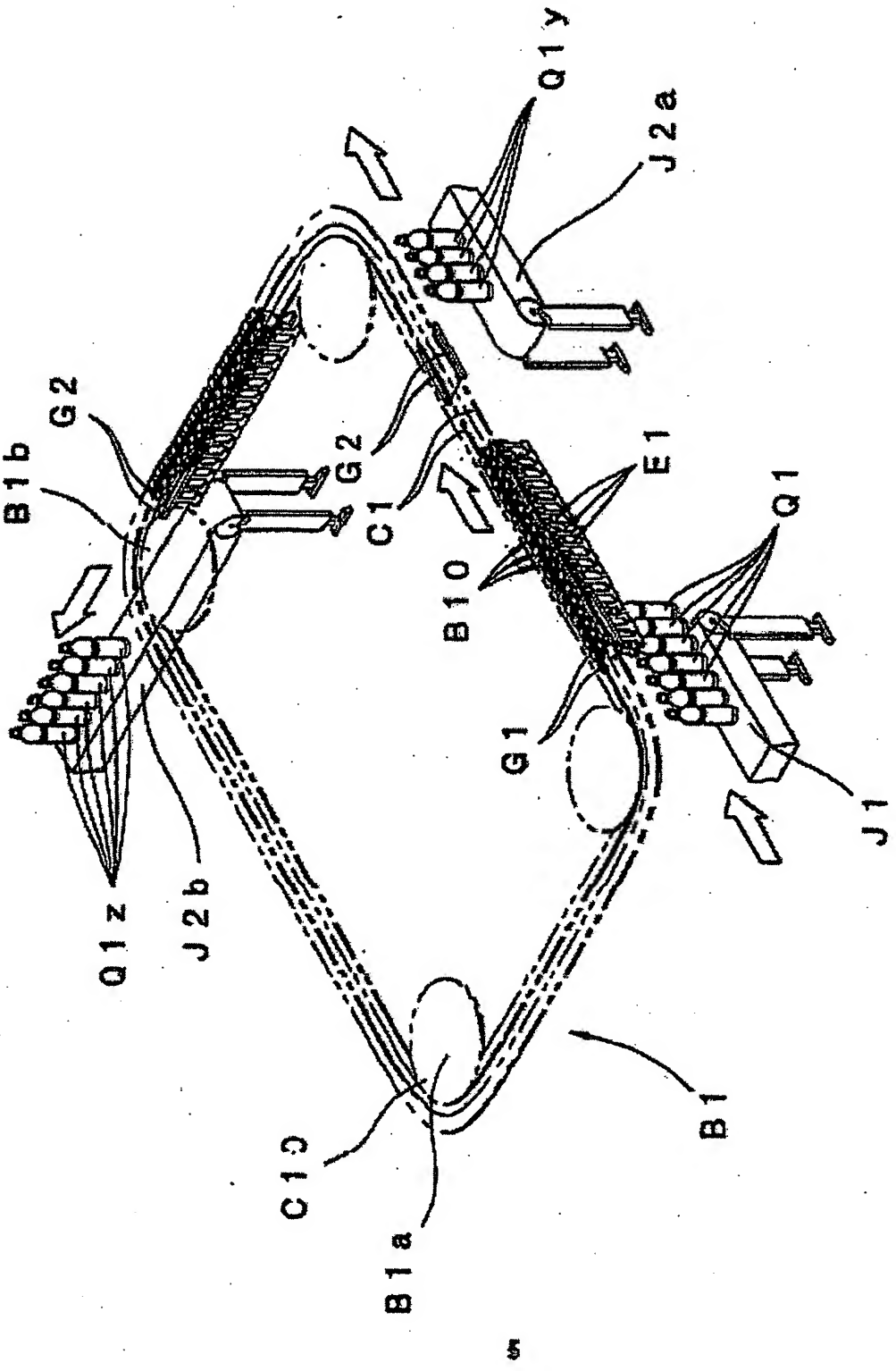
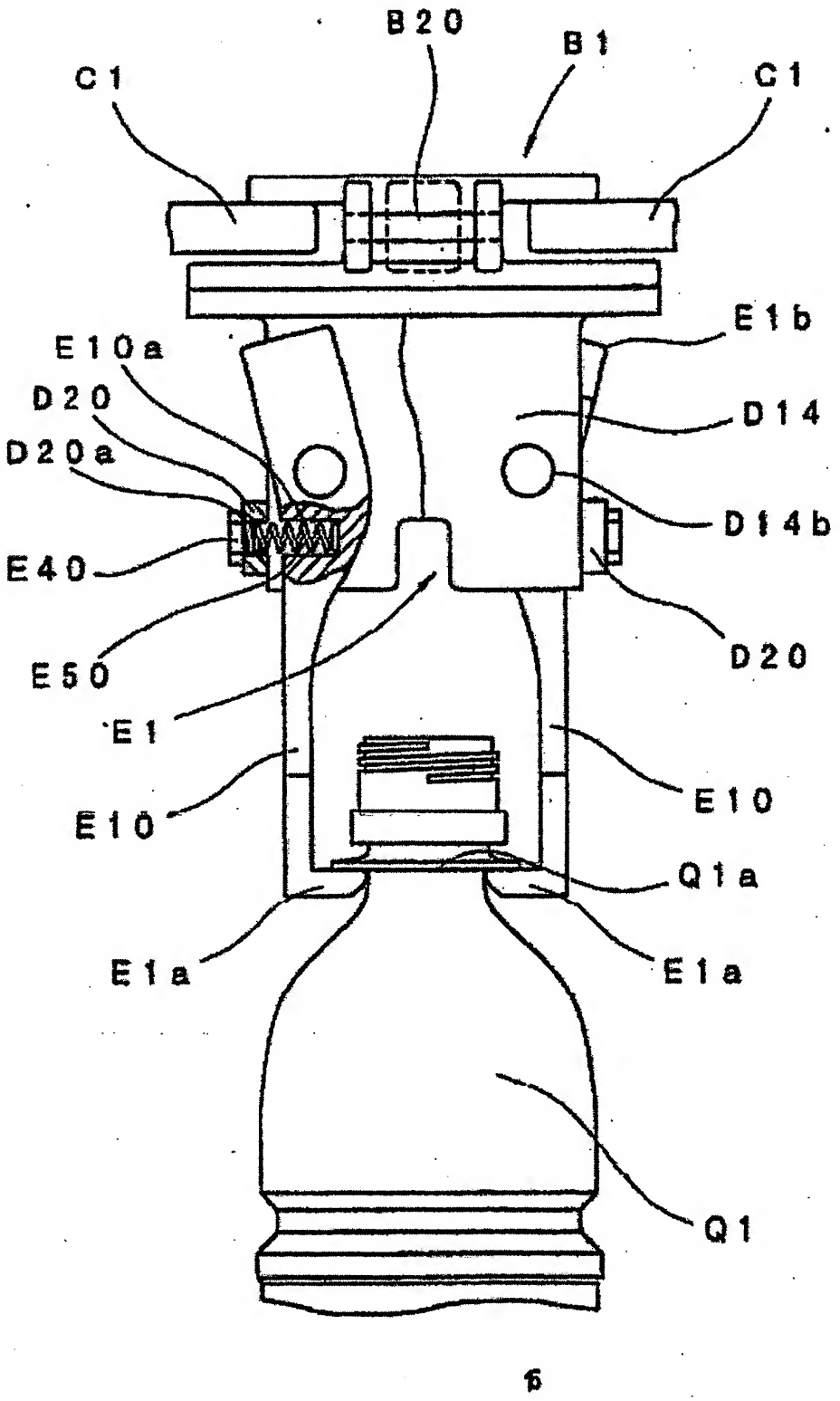


Figure 15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B1
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C1
E10a
D20
D20a
E40
E50
E1
E10
E10
E1a
E1a
E1b
D14
D14b
D20
E10
Q1a
Q1

Figure 16

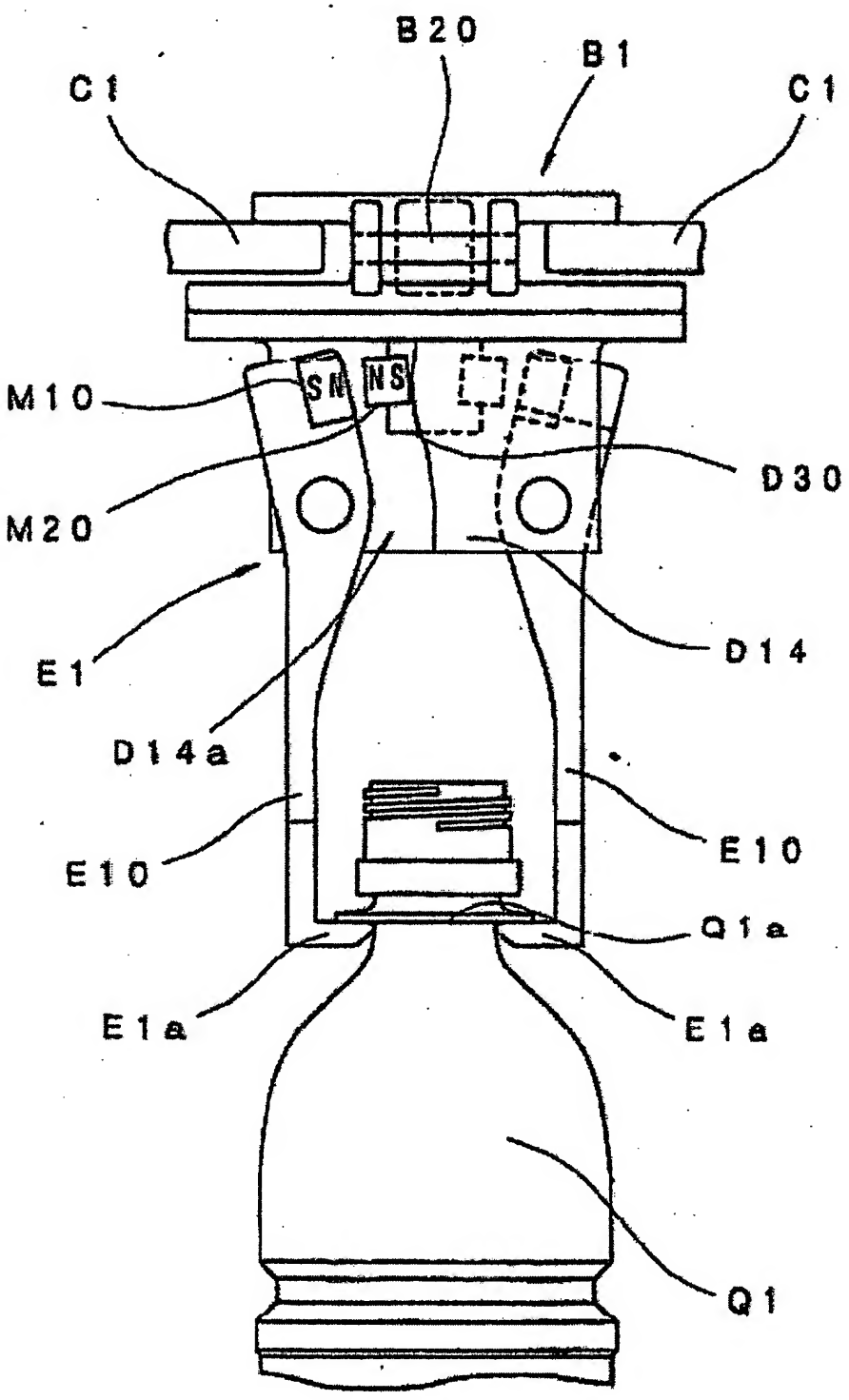
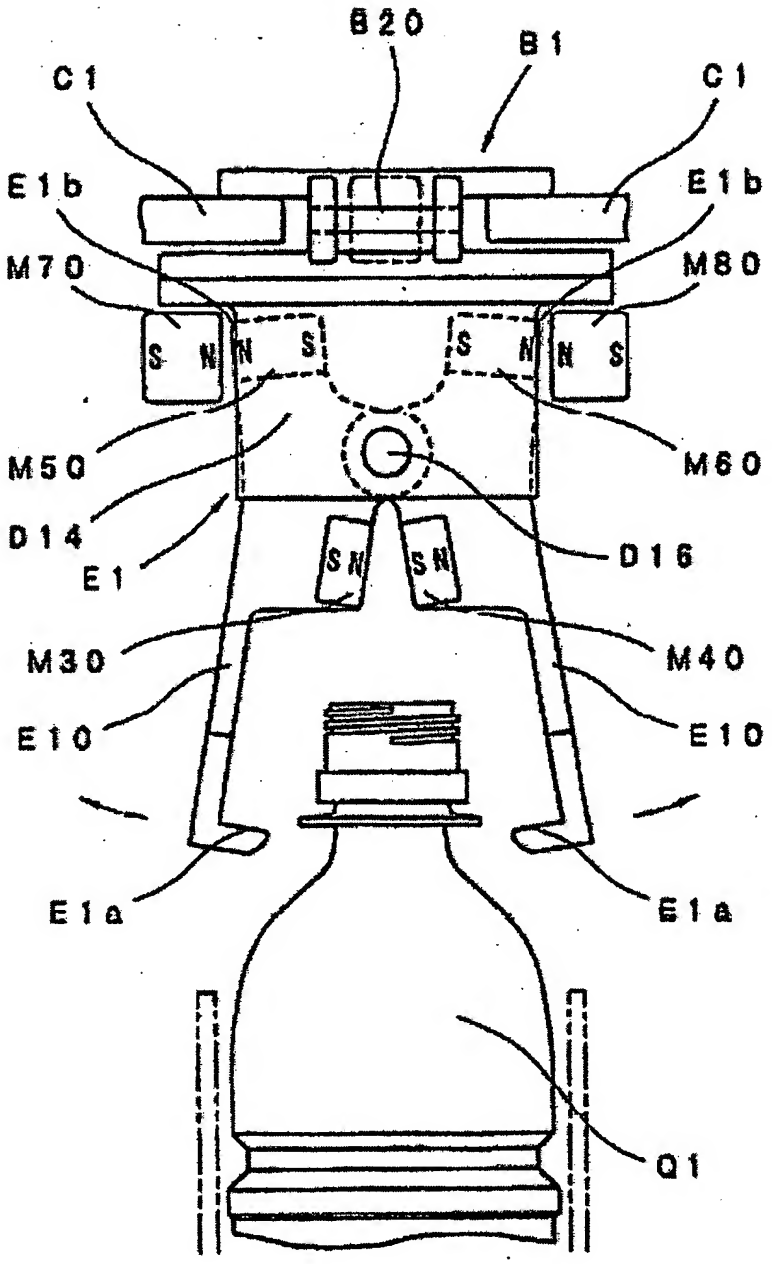


Figure 17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B1
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C1
E1b
E1b
M70
M80
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S N N S
M50
M60
D14
D16
E1
S N S N
M30
M40
E10
E10
E1a
E1a
Q1

Figure 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/01325

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl' B65G 47/86

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl' B65G 47/84-47/86, B65G 47/52, B65G 17/20, B65G 17/46

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-2000
Kokai Jitsuyo Shinan Koho 1971-2000 Toroku Jitsuyo Shinan Koho 1994-2000

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP, 39-5671, B1 (Atokuron, Inc.), 27 April, 1964 (27.04.64) (Family: none)	1-2,4,6,8-10 3,5 7
Y	JP, 62-12607, A (Mitsubishi Heavy Industries, Ltd., CHURYO ENG. K.K.), 21 January, 1987 (21.01.87) (Family: none)	3,5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 June, 2000 (13.06.00)	20.06.00
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)